JANUARY 1952

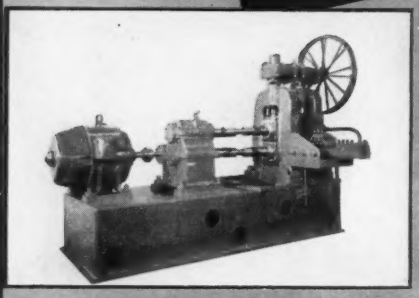
WIRE AND WIRE PRODUCTS

1952
... and more
WIRE
to you!
THE VAUGHN MACHINERY CO.
Cuyahoga Falls, Ohio, U.S.A.
COMPLETE COLD DRAWING EQUIPMENT . . . Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys.

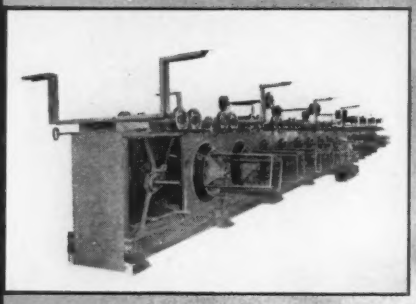
OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

LOOK TO Wean FOR WIRE MACHINERY

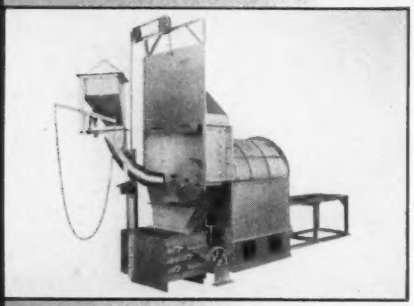
Process OR Product



2—Hi Wire Flattening Mill



Wire Galvanizing Take-Up Frame

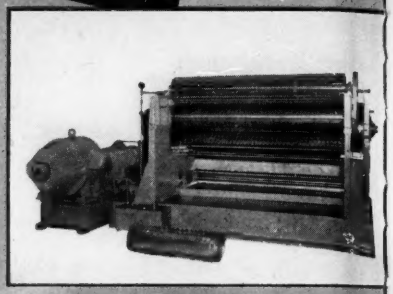


Nail Galvanizing Unit

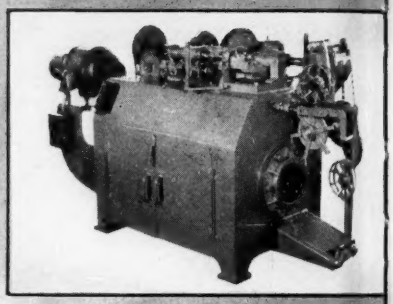
In the past few years tremendous progress has been experienced in the field of wire machinery. Production speeds have been tripled and quadrupled. Product quality has been greatly improved. Machines have been made easier to operate and maintain.

The Wean Equipment Corporation has been a large contributor to this advancement. Wean wire mill specialists have designed, built, and installed wire mill equipment for the leading wire producers the world over. If you make wire you should look to Wean for the best in machinery, service, and facilities.

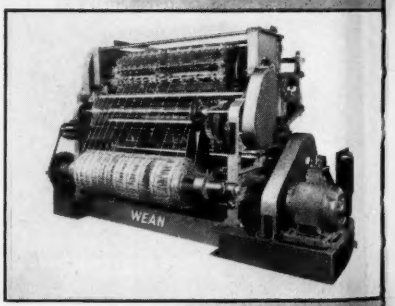
STRIP MACHINERY



Hexagon Netting Machine



2 or 4—Point Barbed Wire Machine



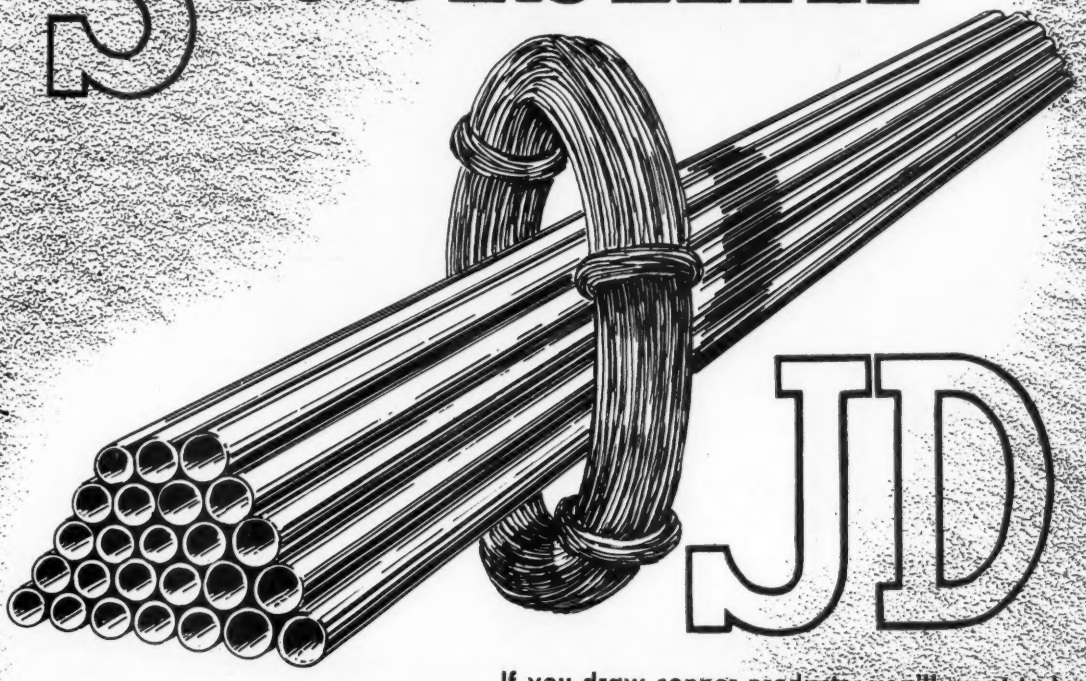
Hinge — Joint Fence Machine

Wean Equipment Corporation
CLEVELAND, OHIO

NEW

For drawing COPPER and COPPER-COATED wire and tubing . . .

Steelskin



JD

If you draw copper products, you'll want to know more about STEELSKIN J. D. Satisfied users of this new Steelskin Product include such companies as Chase Brass and Copper Co. and General Cable Company.

Write today for further information on Steelskin J. D.

Steelskin LUBRICANT

R. H. MILLER

Company, Inc., Homer 1, N. Y.

Lady Looking at *Luxury*

Silver Star Spring Wire is engineered *solely* for coiled upholstery springs.

There's nothing more lastingly luxurious—for sleeping, sitting or riding—than well-designed springs made from fine steel.

A convincing number of bedding and furniture manufacturers count on Silver Star Spring Wire to give comfort—and add sales appeal—to their merchandise.

Sound reasons explain this reliance on Silver Star. Bethlehem carefully processes and inspects special-analysis, high-carbon steel to assure the right tensile strength and toughness. As a result, Silver Star coils and knots readily, makes lively, uniform springs that keep their bounce through years of hard use.

Whether you make innerspring mattresses, industrial springs, kitchen gadgets, or some other product made from steel wire, chances are Bethlehem's modern wire mills can turn out the exact wire you need. Our engineers will be glad to contribute their experience to the solution of any problems you may have in the selection and processing of steel wire.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM WIRE

BETHLEHEM STEEL

WRAP UP YOUR REEL TROUBLES WITH A METAL BINDING

You Can:

REDUCE REEL COSTS • INCREASE REEL LIFE and ELIMINATE REEL REPAIRS with NARCO

METAL BOUND REELS

These fine, long-lasting reels will do all of the above and show savings of up to 300% in reel costs.

For example, a standard all-wood reel will average *four* trips with repairs. A NARCO METAL BOUND REEL of the same size will give you *twelve* to *sixteen* trips — with *NO REPAIRS*. And yet a sturdy, well-made NARCO Reel averages only 50% more in cost to you.

Available in 12″ through 48″ diameters. All-wood reels made from 12″ to any diameter. Shipped assembled or knocked-down, as desired.

May we quote on your requirements?

North Anson Reel Co.

TELEPHONE MADISON 187-2 NORTH ANSON, MAINE

ANOTHER IMPORTANT MEMBER OF WATERBURY-FARREL'S LINE OF WIRE-WORKING MACHINERY

HOW THIS WATERBURY-FARREL WINDER puts trolley wire in its place

This new Waterbury-Farrel Trolley Wire Winder has an automatic, hydraulic, spool-traversing feature that assures a very accurate lay of wire.

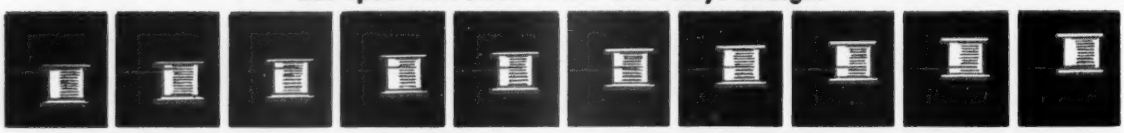
The wire moves straight ahead while the spool itself traverses. It moves across the path of the wire at exactly the right pace to put the wire precisely where it belongs on the spool. A special slip friction device compensates for the build-up of the spool.

This machine can be furnished to take spools up to 56" O.D., 31" barrel with a 26" traverse. It has a maximum capacity of 7,500 lbs. of wire plus approximately 1,800 lbs. for the spool . . . a total load of 9,300 lbs.

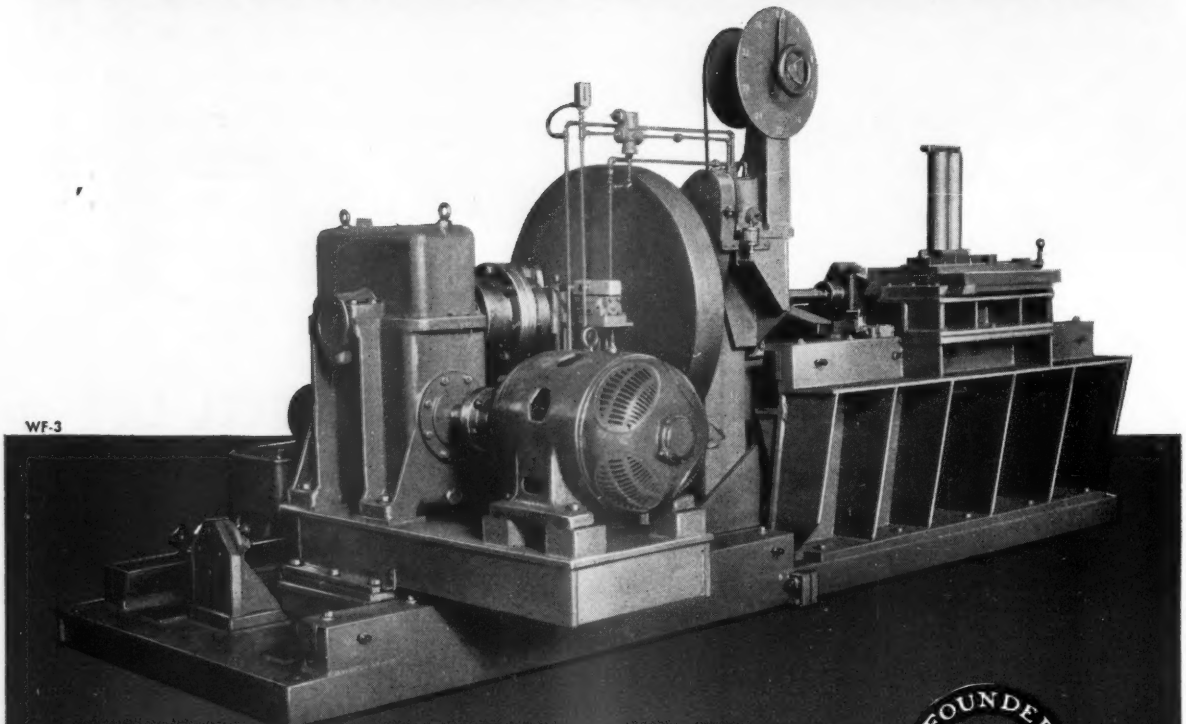
Further information on this machine or on any of the equipment indicated below is available on request.

WATERBURY FARREL FOUNDRY & MACHINE COMPANY
WATERBURY, CONNECTICUT, U. S. A.
Sales Offices: Chicago, Cleveland and Newark

The spool traverses . . . the wire stays straight



WF-3



A FEW OF THE MANY TYPES OF METAL WORKING MACHINERY MADE BY WATERBURY FARREL

WIRE MILL EQUIPMENT—Continuous Fine Wire Drawing Machines • including Upright Cone and Tandem types • Bull Blocks • String-up Machines • Spoolers, Etc. • *COLD PROCESS BOLT AND NUT MACHINERY*—Headers (all types) • Re-headers • Trimmers • Thread Rolling Machines • Slotters • Nut Tappers, etc. • *POWER PRESSES*—Crank • Cam and Toggle; also Rack and Pinion Presses • Transfer Presses • Multiple Plunger Presses • Hydraulic Presses, etc. • *MILL MACHINERY*—Rolling Mills • Wire Flattening Mills • Chain Draw Benches • also Slitters • Straighteners • Pointers Swagers • Cut-off Saws • Coilers • Winders, etc.

FOUNDED WATERBURY FARREL 1851

In Equipment, Experience Counts . . .

WIRE AND WIRE PRODUCTS*

Reg. U. S. Pat. Off.

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable.

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 27 JANUARY, 1952 No. 1

Designated as Official Publication By The Wire Association

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FLANGED STEEL TRAVERSES

... eliminate the labor of handling large numbers of small parts ... make it easy to assemble reels in four simple steps.

And, they make up into strong reels that can be used over and over. Actual experience records show as much as sixteen years' service without refinishing or major maintenance, as well as a 50% to 100% increase in the number of trips before cut downs or scrapping of wooden heads.

Niles Flanged Steel Traverses are manufactured in sizes up to 56" diameter and 48" traverse—in plain, painted or hot dip galvanized finish—as light as 18 gauge steel. Width of flange and number of bolt and drain holes are furnished to your specifications. Available for prompt delivery. *Write for prices.*

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Manufactured Under License Arrangements With Western Electric Co., Inc.

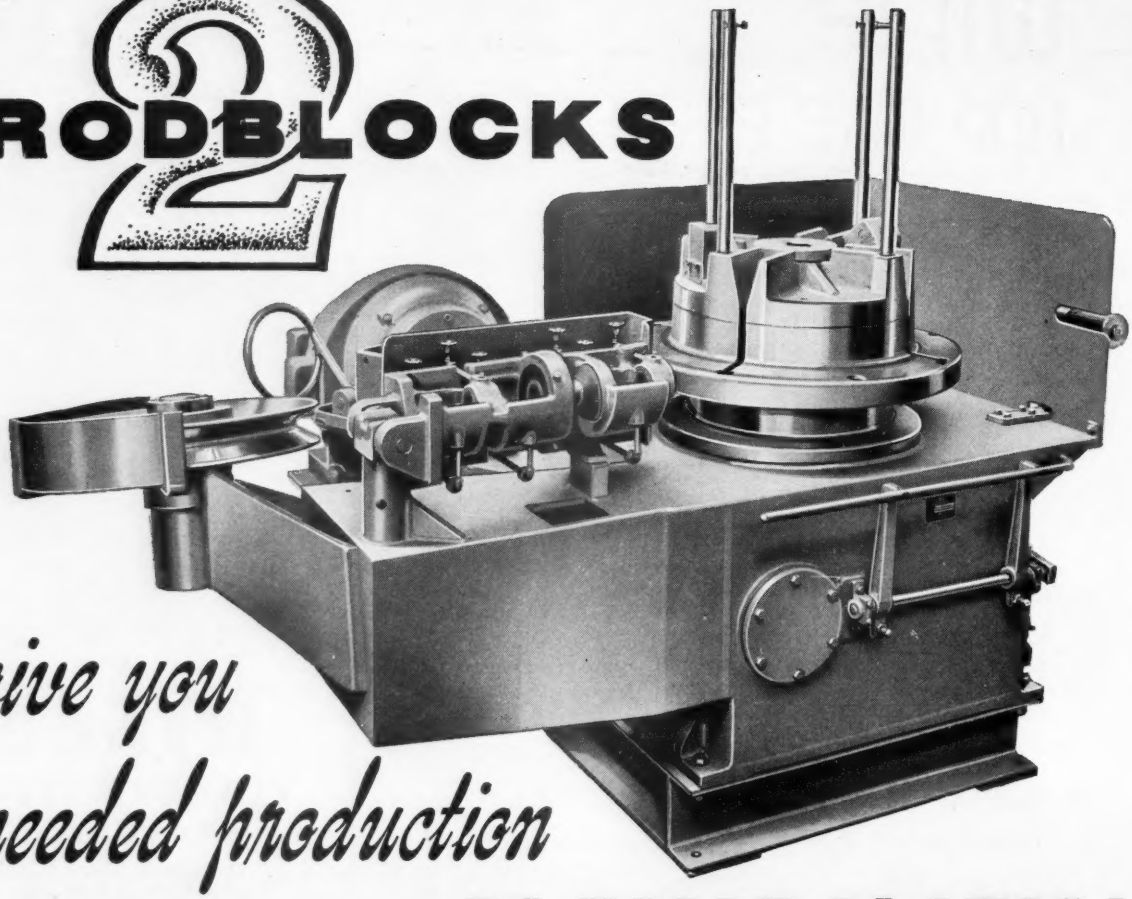
REPUBLIC STEEL

NILES STEEL PRODUCTS DIVISION

REPUBLIC STEEL CORPORATION

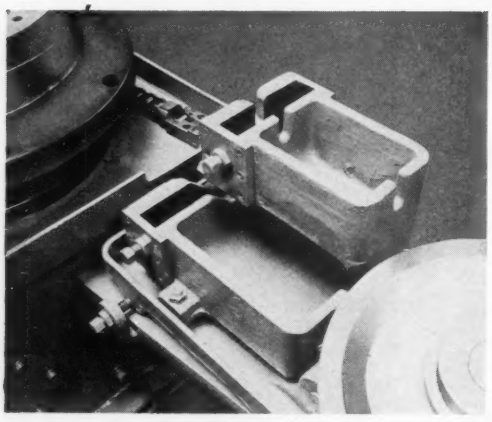
NILES • OHIO

2 RODBLOCKS



give you needed production

FLEXIBILITY!



★ To meet accelerated requirements confronting most of the wire industry SYNCRO reminds you of two outstanding **RODBLOCKS.** The **POPULAR COMBINATION HEAVY DUTY UNIT FOR DRAWING AND SHAVING** illustrated above incorporates the highly efficient cone worm drive for maximum performance. It can handle loads to 125 H.P. capacity. It can process non-ferrous rods as heavy as 1" in diameter. It operates with either A.C. or D.C. drives. Block slots allow introduction of an internal non-riding type stripper.

WHEN ROD SHAVING IS NOT REQUIRED but just straight drawing is needed, the machine generally as illustrated above can be furnished with SYNCRO'S exclusive **DOUBLE DECK DIE HOLDER** as shown in the inset. This feature eliminates the re-positioning of die boxes, complicated stringing and intricate die holder elevating mechanisms. Both units assure you profitable operation with the flexibility needed to meet present day production demands.

Write us for further details as to how SYNCRO can assist your production.

SYNCRO *Machinery for the Wire Industry*

SYNCRO MACHINE COMPANY • PERTH AMBOY • NEW JERSEY • U.S.A.

Inflation is about to get another shot in the arm with a new round of pay raises in the steel industry. Prices will go up, all along the line, and 150 million Americans will take it on the chin.

Let's try economizing, instead, by cutting down some of the waste that goes on in a wire mill. Let's start with your coating tanks. It won't make all the difference, but it will help.

No matter how economical your present coating system is, we honestly believe that **TREMBICOAT** can cut your coating costs. We have three good reasons for believing this . . . first, because the price is so very low . . . second, because the solution life is so very long . . . and, third, because **OUR CUSTOMERS TELL US SO.**

TREMBICOAT is not just a raw chemical, poured from a bag into a drum and labeled "coating compound". **TREMBICOAT** is made as carefully as a prescription, to provide the controlled alkalinity which makes it stand up under iron sulphate from three to five times as long as any other wire coating.

Nor, do we ask you to add your own wetting agent. **TREMBICOAT** is a complete coating compound, engineered to do the best possible job, at the lowest possible cost, and without any "babying".

TREMBICOAT also has a wider application than any other coating — gives better results on a greater variety of wire types.

If you dump your coating tanks more than **THREE TIMES A YEAR,** your coating cost is too high, no matter what coating material you use. Let us *prove* to you that **TREMBICOAT,** pound for pound compared with any other coating, is cheaper in the long run.

TIOXICOAT*

KOPPERFILM

TREMBICLEAN

*Pat. Pending.

THROUGH THIS DIE PASSES THE MOST BEAUTIFUL WIRE IN THE WORLD - DRAWN WITH TREMBICKI COATING COMPOUNDS.

THE TREMBICKI COMPANY

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SELL YOUR BRASS MILL SCRAP PROMPTLY

To keep production rolling

Help lick the shortage of brass and copper. Make sure that every pile of brass mill scrap in your factory – even if it is only a hundred pounds – is sold at once.

Not only is this scrap immediately salable on today's market – it will bring vital metal to the production lines where it is sorely needed.

Both the defense program and civilian needs require more and more copper and brass. To prevent increased shortages and even more stringent regulations, see that *your* brass mill scrap is moved promptly.

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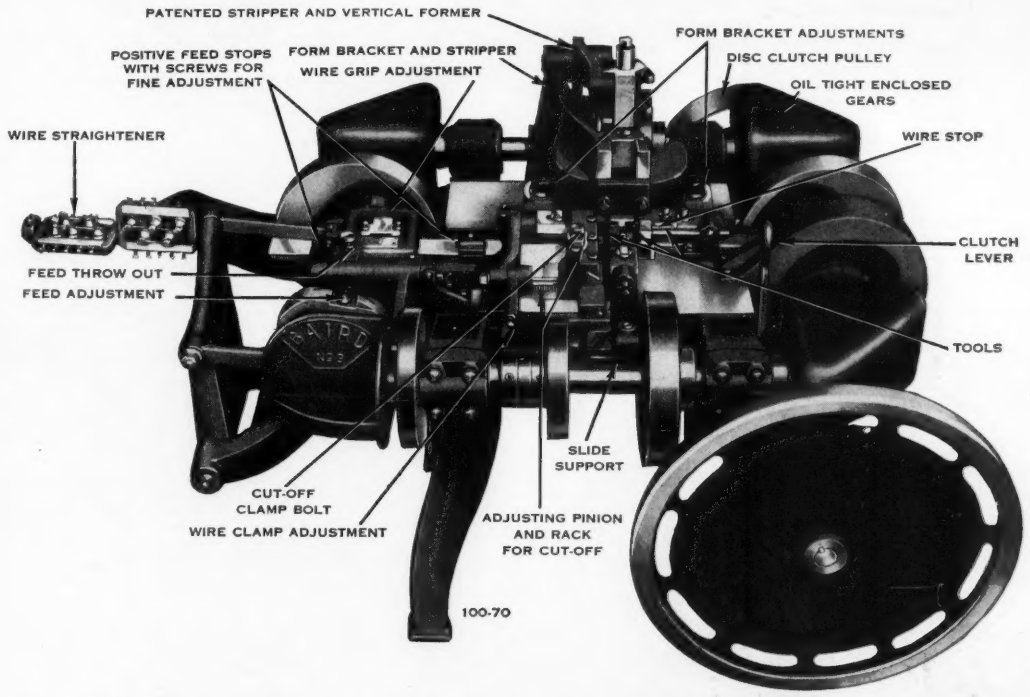
ASK **BAIRD** ABOUT IT!

HIGH PRODUCTION TOOLING



WIRE FORMS and COILED STRIP WORK *"unlimited"* with BAIRD FOUR SLIDE Automatics

The FOUR SLIDE is actually a basic design of machine, not a jack-of-all-trades, but one which we stock and tool to your specific requirements for high speed repetitive production. There are 8 standard sizes that cover wire diameters from 1/32" to 1/2" and ribbon widths from 3/16" to 1-3/8" . . . larger capacities on special order.

Machines may be supplied with crowned pulley for V belt drive from countershaft, or with standard or variable speed motor drive mounted directly on the machine . . . V belt from motor sheave to machine pulley. Operation is smooth and quiet.

Tooling possibilities are extensive and can still be increased by the ingenuity of the toolmaker.

Standard attachments are Form Raising, Pin Pulling, Ring Setting and Horizontal Presses. Special attachments will be designed and built to suit specific jobs.

To discover how you can cut costs with this Four Slide machine . . . "ask Baird about it."

the **BAIRD MACHINE COMPANY**
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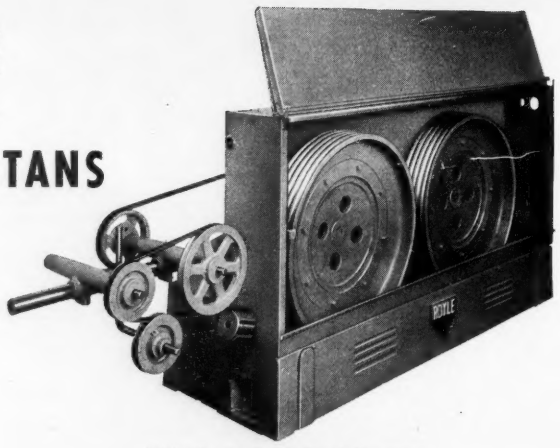
AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS

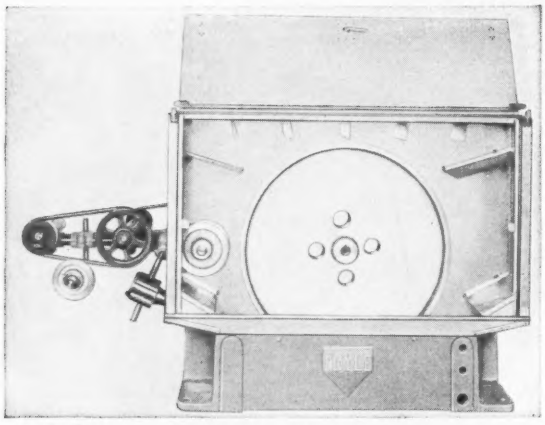
SBAST

ROYLE { LIGHT WIRE and CABLE CAPSTANS

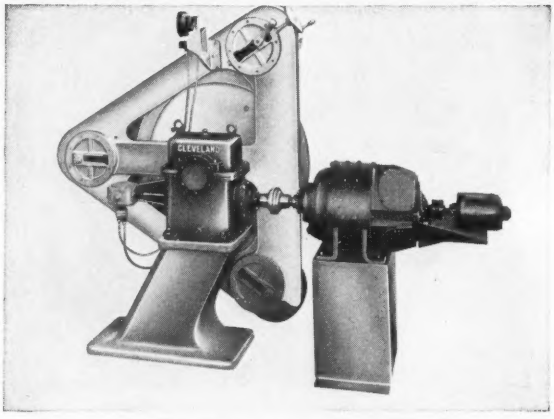
- ★ Continuous Vulcanizing Machines for Rubber Wire Insulation
- ★ Plastic Wire Insulation Machines
- ★ Strainers
- ★ Cooling Troughs
- ★ Motorized Take-Ups
- ★ Temperature Control Units



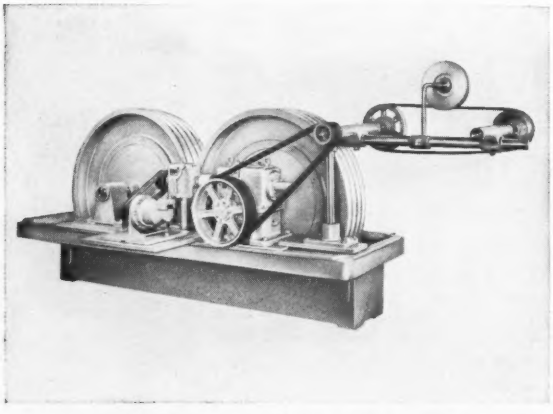
36" Heavy Duty Dual Capstan



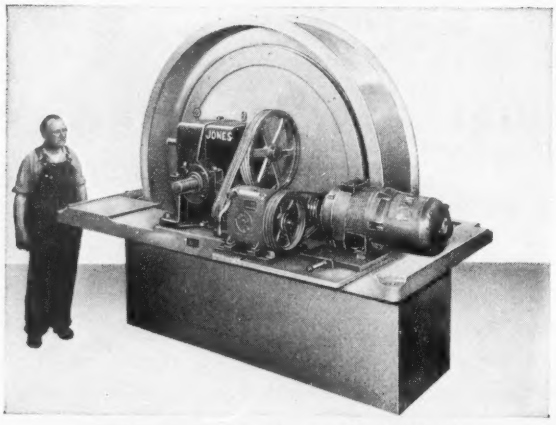
36" High-Speed Capstan



Special 36" Western Electric Capstan.
Floor mounted with separate motor drive.



60" Dual Capstan. Also available in 84".



84" Single Capstan. Also available in 60".

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ROYLE PATERSON N. J. 1880

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102 YEARS OF SERVICE

In Recognition
Of the Founders, Managers and Employees of this Company who have so fully contributed to the Economic and Social growth of their Community, the State of Connecticut and the United States of America for more than
One Hundred Years
THE MANUFACTURERS ASSOCIATION OF CONNECTICUT, INC.
Awards this CERTIFICATE of APPRECIATION to
The Hartley Tool & Die Co.
Established in Connecticut 1850
In Witness Whereof these presents have been signed, sealed and delivered by The Manufacturers Association of Connecticut, Inc., This twelfth day of September A.D. One Thousand Nine Hundred and Fifty
PRESIDENT

With five generations of Hartleys ever striving to serve you better and more efficiently.

It is small wonder, then, that Hartley's Tungsten Carbide Dies have attained a degree of excellence that spells savings for you in your wire drawing operations.

The Hartley Tool & Die Compan is proud to reproduce the certificate recently awarded to it by the Manufacturers Association of Connecticut for their long period of successful service to its community, the state and to industry.

Long-experience and ingenuity in the manufacture of wire drawing dies and other standard carbide products has made Hartley Dies both lower in first cost and more economical in wire, tube, heading and other production costs.

You need not guess as to the quality of your dies if they bear the HARTLEY trade-mark.

Special and shaped dies engineered to meet your needs.

Send for catalog and price list on standard carbide dies.

WATCH FOR THE HEART ON *Every* DIE

your assurance of highest quality and service

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A REPUTATION BOUND WITH MILES OF SPIRAL WIRE

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TRADE MARK REG. U.S. PAT. OFF.

● Have you ever noticed the spiral binding on your stenographer's notebook? Chances are, it's made of KOKOTE . . . an unusually bright steel wire with a chrome-like lustre. Because KOKOTE has a desirable degree of stiffness, it is used by one of our customers to make these wire bindings. Not only books, but this manufacturer's reputation—and ours—are inevitably bound with it. We feel, therefore, the greatest responsibility toward our customer and his wire-fabricating problems.

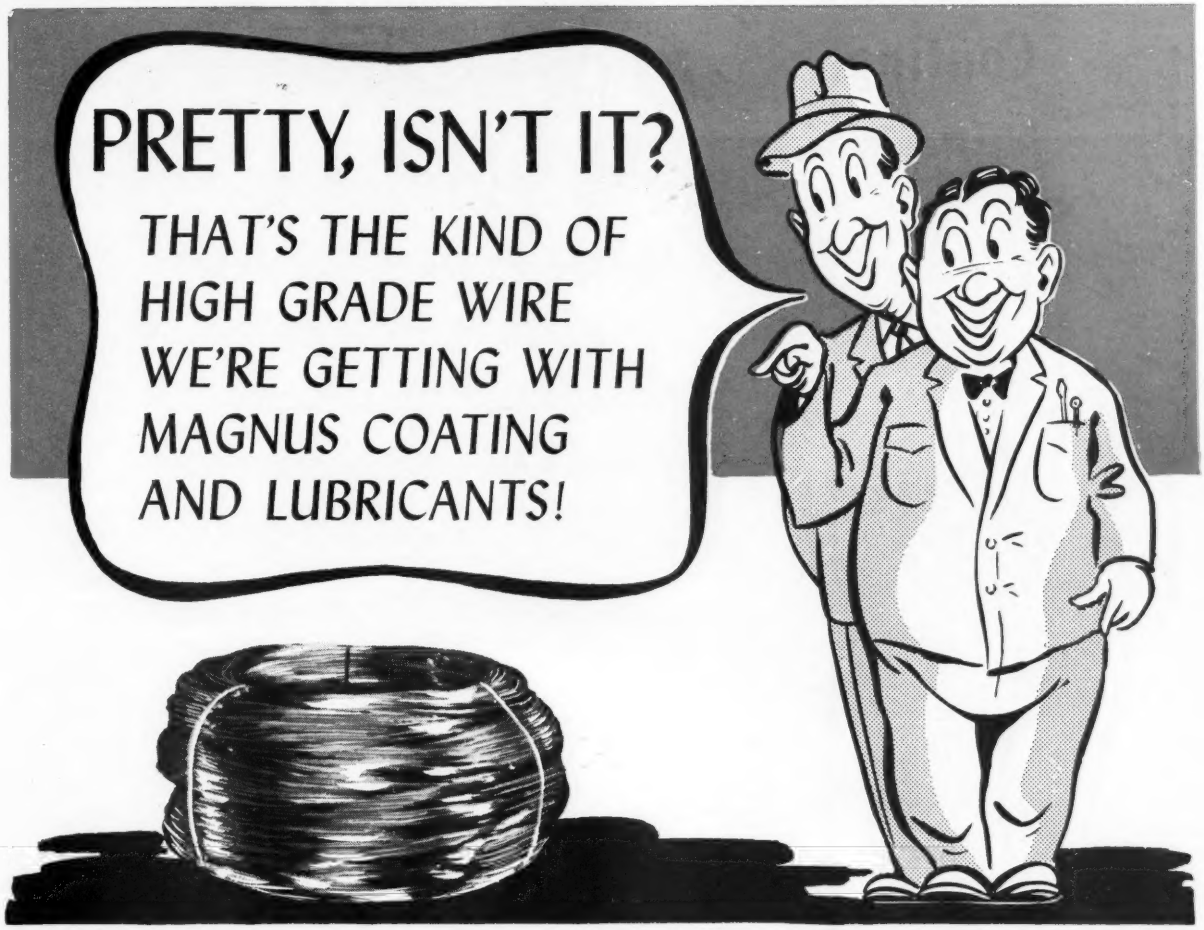
There is this kind of "family" relationship between Continental and the many manufacturers we supply with lustrous KOKOTE . . . whether they use our wire for spiral bindings, broom wire, or paper clips. We act in the belief that business success ultimately depends on SERVICE . . . so you'll always find us ready and willing to help you. If you are troubled by a particular problem, please feel free to write us, without obligation.

CONTINENTAL STEEL

CONTINENTAL STEEL CORPORATION

GENERAL OFFICES • KOKOMO, INDIANA

PRODUCERS OF *Manufacturer's Wire* in many sizes, shapes, tempers and finishes, including Galvanized, ● KOKOTE, Flame-Sealed, Coppered, Tinned, Annealed, Liquor Finished, Bright, Lead Coated, and special wire. ● ALSO, Coated and Uncoated Steel Sheets, Nails, Continental Chain Link Fence, and other products.



It's a well-known paradox of value that the best is often the lowest in ultimate cost.

Many mills, originally using Magnus Metalcoat 267, Dri-Draw #4 and other of our quality line of wire drawing materials on premium jobs ONLY, obtained over-all cost reductions per ton of wire that pointed the way to using the Magnus Method throughout the mill.

•

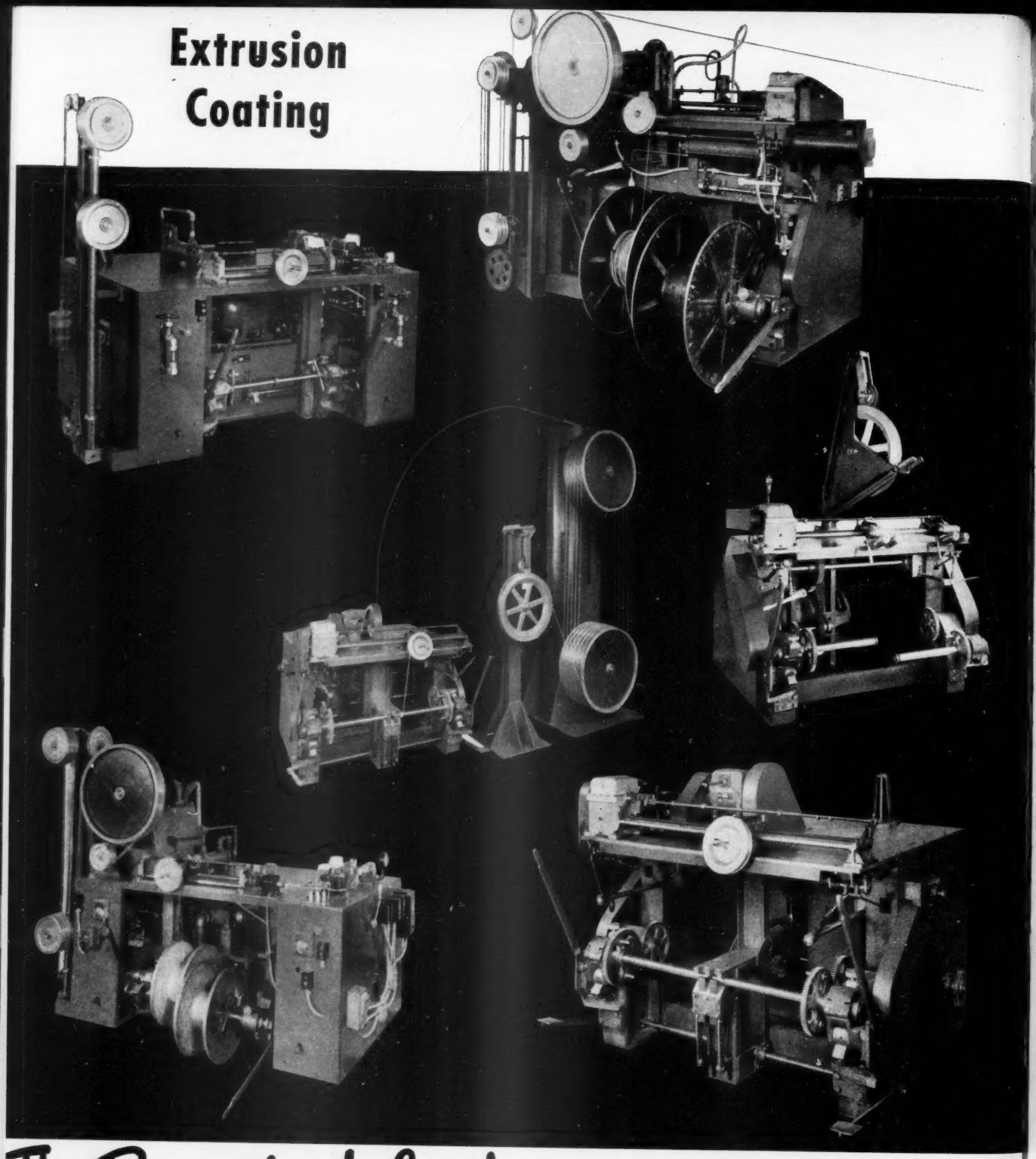
It won't cost you a cent to try these methods on your toughest problems. Drop us a card or letter.

A Magnus Specialized PRODUCT

WIRE DRAWING DIVISION

MAGNUS CHEMICAL CO., INC.

SOUTH AVENUE • GARWOOD, N. J.



The Recognized Leaders IN THE WIRE INDUSTRY

USE THIS CONTINUOUS EXTRUSION MACHINERY

For Extrusion Jacketing with Polyvinyl, Nylon, Polyethylene and Rubber

INDUSTRIAL IOI ENGINEERING VERSATILITY **OVENS, INC.**

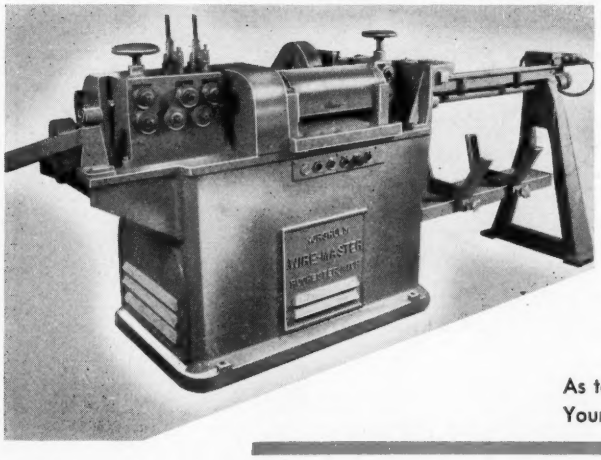
13825 TRISKETT ROAD CLEVELAND 11, OHIO

"Wire Master"

Faster, More Accurate
STRAIGHTENING and CUTTING
with the

NORS-HOLM "WIRE MASTER"

So fast, a customer is finding that *two* machines will do the work of *six* machines formerly used



Model C, shown at left, will handle .125" to .312" wire. Several other models are available.

NORS-HOLM "WIRE MASTER" machines will also straighten and cut capillary tubing. Cuts clean so that the hole is not closed.

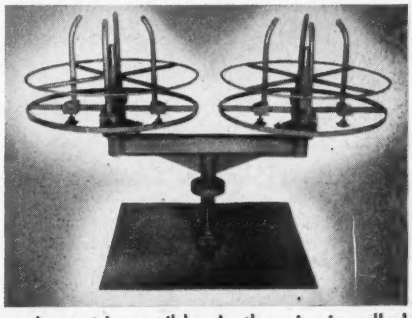
The "WIRE MASTER" cuts lengths as small as 1½" to within .005" tolerances, with the *cleanest and most accurate* cut-off on the market.

UNIQUE BALLBEARING FLOATING SPINNER will eliminate feed roll dragmarks.

As to speeds, 180 to 200 F.P.M. is the minimum to be expected. Your cutting jobs will be studied and the speeds *guaranteed*

For Easy Loading and Economy. Built in Three Types:

Nors-holm "Reel Master"



1) HEAVY DUTY DOUBLE REEL, 2) TILT TYPE, 3) SINGLE REEL. Engineered by men experienced in all phases of wire working, NORSHOLM REELS embody advanced design features that assure increased production. Are rugged and precision made, built for endurance and high efficiency. Models vary from small single reels for light wires to large reels for 500 lb. coils of wire. All are ball-bearing equipped.

With the HEAVY DUTY DOUBLE REEL, shown above, greater yield from wire equipment is possible. As the wire is pulled from one reel, the other is loaded, eliminating down-time. Foot pedal allows reel to index 180° to make ready for new coil.

Write today for information on these remarkable machines.

NORS-HOLM MACHINE DIVISION

NORS-HOLM INDUSTRIES, INC.

808 S. ROCHESTER ROAD • ROCHESTER, MICHIGAN

A Regional Meeting

of

THE WIRE ASSOCIATION

will be held at PITTSBURGH, PA., May 8-9, 1952

at the William Penn Hotel

This meeting promises to be of great interest and importance. It will include plant inspection trips to the Firth-Sterling Steel and Carbide Corporation's plant at McKeesport and another to the Pittsburgh Steel Company's wire mill at Monessen.

The Program Chairman is Tom M. Girdler, Jr., of Republic Steel Corporation, with C. Raymond Harmon, of Firth-Sterling as Assistant Chairman. The technical sessions will include a symposium and two papers, with William E. Hill, Jr., of Russell, Burdsall and Ward Bolt and Nut Company serving as Chairman of the technical sessions. Full details on the program will be published in succeeding issues of WIRE AND WIRE PRODUCTS.

There will be a fine banquet on Thursday evening, with interesting speakers to be announced later. Tickets for the banquet will cost $6.00 per plate.

A registration fee of $6.00 will be charged, that will include the cost of your trip on the busses to the two plants to be visited. All persons going on these trips must have this ticket with them and *wear* their badges. The Committee advises that no one will be permitted to enter the plants except those arriving on the special chartered busses and *wearing their badges*. This is a security measure.

You should plan to arrive early and register promptly on Thursday morning in order to get your tickets for the inspection trips, the first of which will start Thursday at 1:30 p.m.

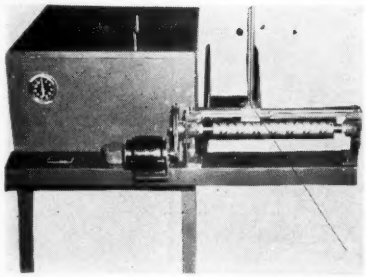
Please make your plans at this time to attend the Pittsburgh Regional Meeting. Hotel reservation cards will be mailed to members in the Spring.

THE WIRE ASSOCIATION

Richard E. Brown, Executive Secretary

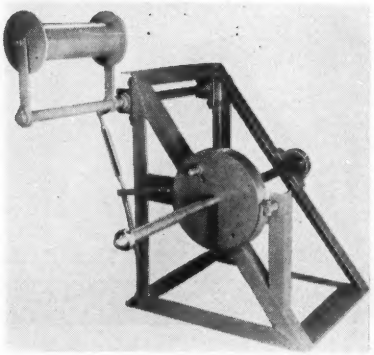
453 MAIN STREET **STAMFORD, CONN.**

DAVIS EQUIPMENT
FOR ELECTRIC WIRE AND CABLE

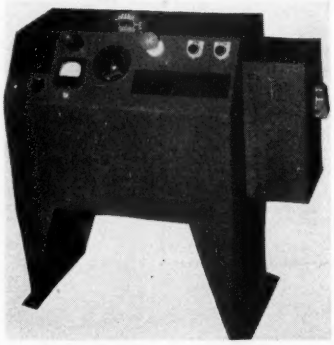


1. Davis Takeup or Reeler engineered specially for spooling covered wire at speeds up to 1,000 feet per minute. Equipped with Davis' automatic traverse and automatic tension, and wire speed indicator for reels up to 30" diameter.

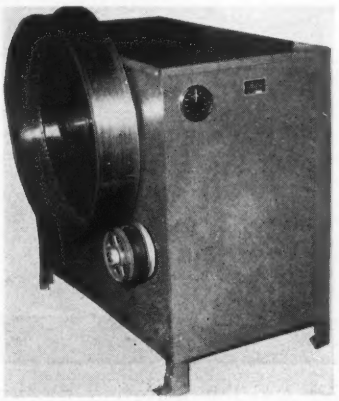
5. Davis Measuring Machine. Adjustable for wire or cable up to 1½" in diameter. Equipped with two knurled wheels to prevent slippage. Speeds up to 2,000 feet per minute.



2. Davis rugged Reel Stands are built for reels up to 30" in diameter. All Davis Reel Stands are equipped with ball bearings, feeder rolls, and automatic tension brakes.



3. The famous Davis Spark Tester unit for use in locating current leak in covered wire. Usually located between Capstan and Takeup, but can also be used during a rewinding operation. Warning light or horn informs operator of breaks in covering.



4. Capstan designed and built by Davis especially for drawing covered wire from extruders. Variable speed drive and adjustment for wire speeds up to 1,000 feet per minute. Transfer pulley and speed indicator included with Davis Capstan.

Any equipment will be specially engineered and built for you to fit your particular needs. Let this new and progressive organization demonstrate to you what fast, competent and courteous service can mean. All orders will be given definite shipping dates that will be adhered to. The DAVIS policy of low prices will be continued.

Write today for detailed information!

DAVIS EQUIPMENT

DAVIS ELECTRIC CO. • WALLINGFORD, CONN.

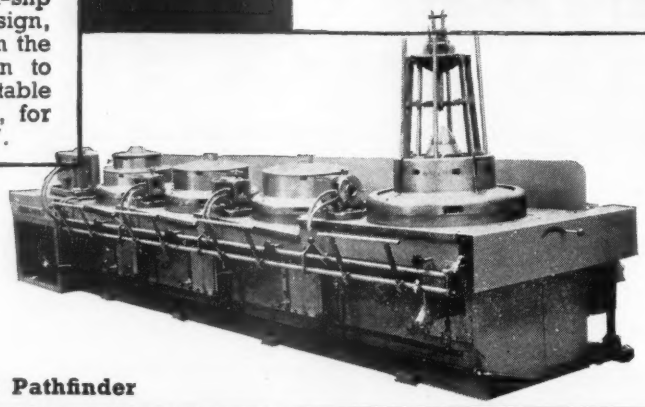
Successors To The R. L. Davis Electric Co., Inc.

HARNESS TESTERS • PAY-OFFS • TRAVERSES

SPARK TESTERS • SPOOLERS • TAKE-UPS

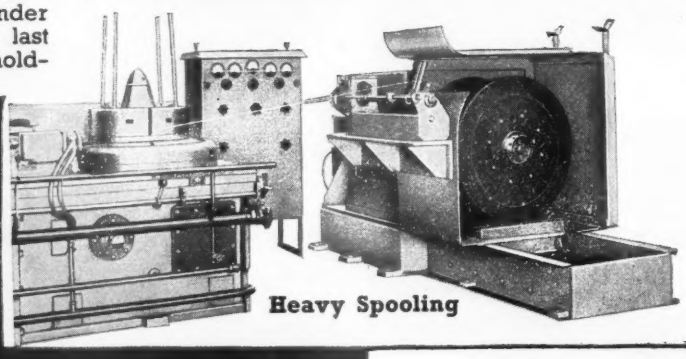
STEEL WIRE

A straight-through, non-slip machine of advanced design, drawing at high speed from the rod either in coils or on to heavy spools. Specially suitable for heavy inlets, finishing, for example, five holes to ·200".



The Pathfinder

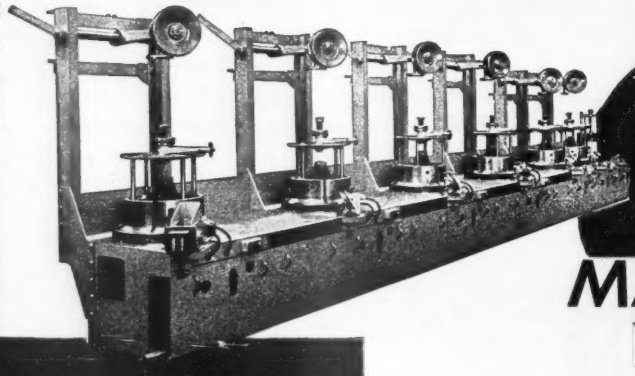
The practice, common in the copper wire industry, of finishing steel wire on spools, is a growing one. This photograph shows a Pathfinder delivering from the last block on to a spool holding two tons of wire.



Heavy Spooling

This and the following picture show two types of the useful and ubiquitous accumulation machine. The A.36 is the heavi est type we make. It takes blocks up to 30" diameter and motors up to 30 H.P. per block.

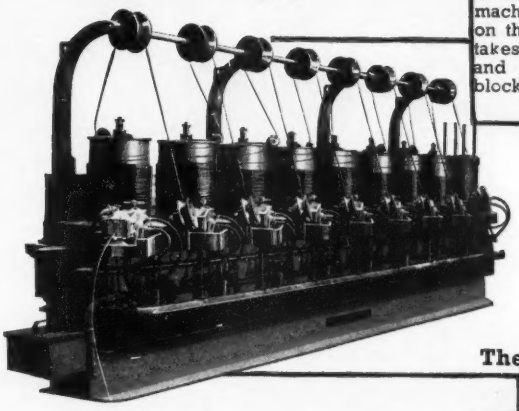
Accumulation Machine Type A.36



MARSHALL

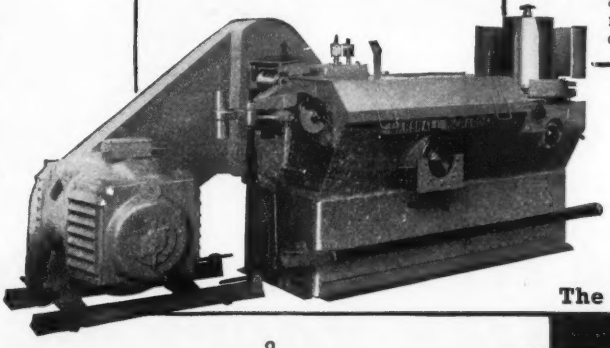
DRAWING MACHINERY

THE SIX MACHINES ILLUSTRATED ARE TAKEN FROM OUR COMPREHENSIVE RANGE OF MACHINES FOR DRAWING STEEL WIRE. ALL HAVE BEEN THOROUGHLY PRODUCTION TESTED AND THE EXPERIENCE GAINED IN USE HAS BEEN CAREFULLY EMBODIED INTO THE DESIGNS TO ENSURE HIGH PRODUCTION OF GOOD QUALITY WIRE FOR A LONG TIME.



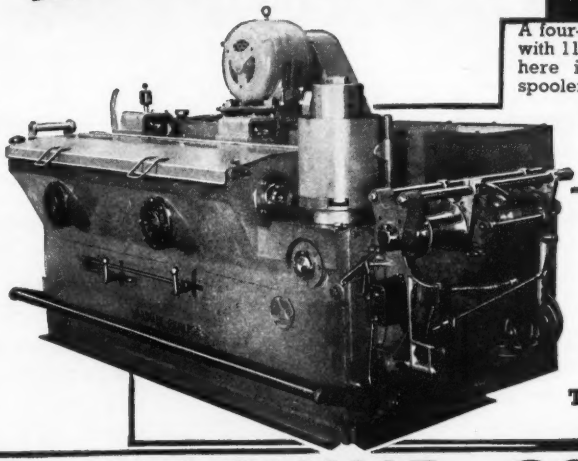
A smaller variety of accumulator machine than the type A.36 shown on the opposite page. This type takes blocks up to 12" diameter and motors up to 15 H.P. per block.

The Type A.20



A useful fine wire machine with 9 dies, drawing with the cones and dies fully submerged. Capable of a total overall reduction in area of about 83% and of taking inlets up to about ·080" diameter.

The 9.MS.2



A four-cone submerged machine with 11 or 13 dies. The one shown here is fitted with a magnetic spooler for 20 lb. spools. On this and the 9.MS 2. shown above, the dies reciprocate and powerful jets play under the liquor into the entrance of each die.

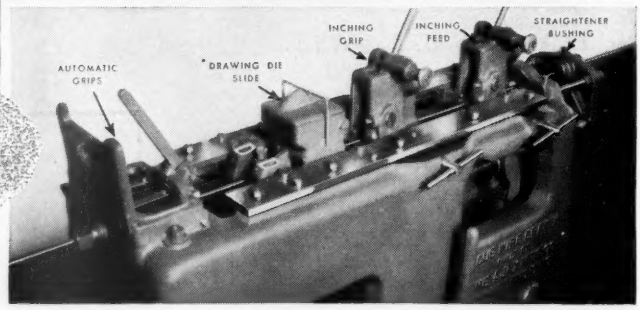
The F.S.4

RICHARDS MACHINE CO. INC.

1100 SOUTH BROAD STREET · TRENTON 10 · NEW JERSEY
Telephone: TRENTON 9478 · Telegrams: MARICH TRENTON

MRC8

AJAX-HOGUE DRAWERS
with 5/16" Waterbury-
Farrel Hi-Pro Headers



High Production Heading with AJAX-HOGUE Drawn Wire

Progressive bolt manufacturers throughout the country are achieving greater efficiency and lower production cost with Ajax-Hogue wire drawers coupled to their headers.

Hogue drawn clean, straight, accurate to size wire eliminates almost all of the avoidable down time, saves much of the wear on the header dies, makes it easily possible to change the wire size to meet requirements. It also effects a saving in the cost by using hot rolled rod instead of more expensive mill drawn wire.

If you operate any headers, regardless of make, which are not equipped with Ajax-Hogue wire drawers write for Bulletin No. 111 in order to learn more about the advantages of these drawers.

THE Ajax MANUFACTURING COMPANY
EUCLID BRANCH P. O. CLEVELAND 17, OHIO
110 S. DEARBORN ST. CHICAGO 3, ILLINOIS
DEWART BUILDING NEW LONDON, CONN.

TWO NEW USES FOR NO. 21 WAX

1. A small amount of No. 21 WAX in borax coating will show decided advantages in drawing wire:

   A. No wetting agent necessary—just borax and 1% to 1½% of No. 21 WAX.

   B. Will help prevent the natural tendency of borax to be somewhat hydroscopic.

   C. Cheapest possible lime substitute. In many cases less borax per gallon of solution has been used.

2. A small amount of No. 21 WAX on patented wire coming out of the patenting furnace will help prevent scouring and wear on the take-up blocks and will save many times its cost in repairs.

PROTECTS BRIGHT FINISHES, LUBRICATES, PREVENTS RUST

Call or Write Headquarters or Any Standard Service Center:

INDUSTRIAL COMPOUNDS CO.
C. R. Mehl, President
1010 San Fernando Road
Los Angeles, California

INDUSTRIAL COMPOUNDS CO.
C. R. Mehl, President
2425 Seventeenth Street
San Francisco, California

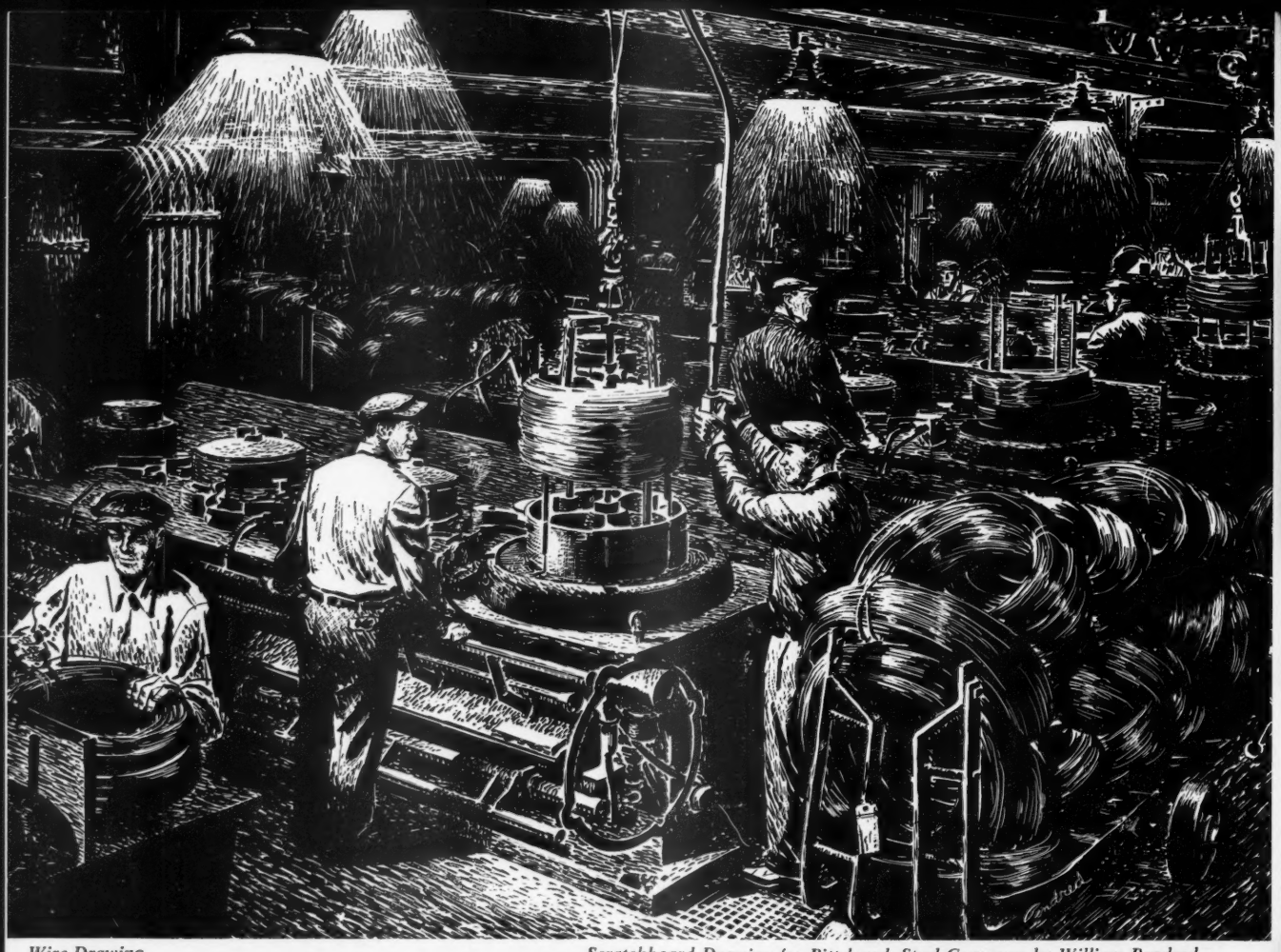
STANDARD INDUSTRIAL COMPOUNDS CO.
ARTHUR J. O'MARA
Millbury, Massachusetts

STANDARD INDUSTRIAL COMPOUNDS COMPANY has pioneered most of the outstanding contributions to better wire drawing through better lubricants. Consult with STANDARD for the solution of your difficult problems. We welcome your inquiries.

wire drawing lubricants

Standard INDUSTRIAL COMPOUNDS CO., INC.

4600 WEST FERDINAND STREET
CHICAGO 44, ILLINOIS



Wire Drawing

Scratchboard Drawing for Pittsburgh Steel Company by William Pendred

Progress in Steel

Steel wire, one of the vital threads that holds civilization together, will soon be produced in even greater quantity at Pittsburgh Steel as a result of the company's planned Program of Progress which will increase its steel-making capacity fifty percent by July, 1952.

Pittsburgh Steel Company today is one of the largest producers of wire in the United States. Shown above is a small segment of the wire drawing department at the Monessen Works. Here, high-quality steel rods are drawn through a series of tungsten-carbide dies to reduce their diameter to the desired wire gauge. With more steel available, it will be possible to increase the wire production of this department plus Pittsburgh Steel's subsidiary, the Johnson Steel & Wire Company with plants at Worcester, Mass.; Akron, Ohio; and Los Angeles, Calif.

The precision wire produced in all these operations serves you and industry in many ways—as special oil-tempered spring wire for tanks, planes, military vehicles, automobiles, agricultural implements, locomotives and household appliances. Pittsburgh barbed wire protects our troops and fences our farms. Wire is also woven and welded into fence to protect military installations, factories, homes and farms. Special cold-heading wire is used for forming into rivets, bolts, screws and thousands of small mechanical parts and fasteners. Other Pittsburgh wire goes into textile looms and such every-day items as automobile tires, paper clips, musical instruments, coat hangers and even bobby pins.

The demand for more wire of all kinds grows daily. Likewise, the nation needs more tubular products, more hot and cold rolled sheet and strip. Pittsburgh Steel's Program of Progress is designed to help meet this demand. The program entails expanding the blast furnace and open-hearth furnaces to provide more steel capacity. This required the installation of a new high-lift blooming-slabbing mill which was completed last year. It includes the construction of facilities for producing hot and cold rolled strip and sheet at the Allenport Works.

At war and at peace, civilization depends upon the millions of tons of steel produced in the United States each year. The industry recognizes the vital necessity of providing more steel, better steel, if civilization is to survive. That is why the Program of Progress at Pittsburgh Steel Company, an important part of the steel industry's vast expansion program, is being rushed to completion.

Pittsburgh Steel Company

Pittsburgh, Pennsylvania

LIGHT WEIGHT

PRECISION BUILT

REDUCED COST

LONGER LIFE

EXTRA STRENGTH

Find Out *Why* Big Industry prefers **ACROPAK*** Spools for Precision Wire Packaging

Complete range of sizes in your choice of TWO production-proven materials:

(1) Drawn **ALUMINUM** alloy Spools — light weight for precision packaging

(2) Rigid precision **STEEL** Spools — for heavy duty processing

Write us today—tell us your problems. We've helped others—and we can help you. It is NOT mere coincidence that some of the biggest names in the Wire Industry standardize on ACROPAKS. It took superiority in *performance* to satisfy them. Let us give you the Facts!

DYNAMIC BALANCE

GREATER PRODUCTION

INEXPENSIVE RECONDITIONING

LESS MAINTENANCE

ATTRACTIVE PACKAGING

*Reg. U. S. Trade Mark

ACROMETAL PRODUCTS INC.

DIVISION U. S. BOBBIN & SHUTTLE COMPANY

616 Fifth Street N. • Minneapolis 1, Minn.

PLASTICS MACHINERY BULLETIN

Reporting News and Machine Design Developments

IN BUSINESS TO **NRM** REDUCE YOUR COSTS

NYLON—New NRM Extruders handle Nylon, other plastics

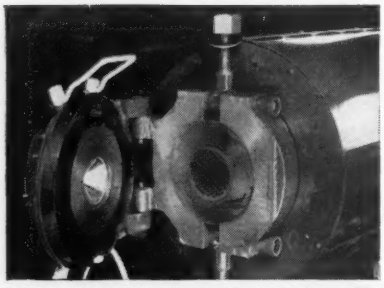
New NRM electrically heated Extruders offer you a valuable plus—with them you can extrude Nylon as well as a variety of other plastics in various forms. With versatile NRM Extruders, producers often avoid purchase of extra equipment.

Standard NRM Models of the new design can be adapted simply and easily in the field, by removing the standard die or crosshead, and substituting a special Nylon die or crosshead. The steps required are shown below.

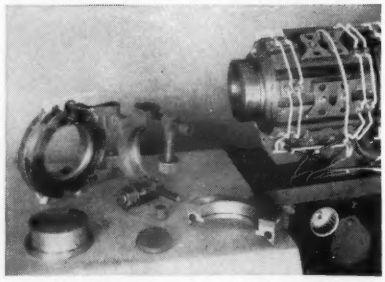
NRM's Nylon Extruders range from a completely self-contained 1"-screw bench model, up through 3½"-screw machines, and larger, if desired. They are currently being used for wire covering and a variety of other applications.

Write for full information to Plastics Machinery Division, National Rubber Machinery Company, Akron 8, Ohio.

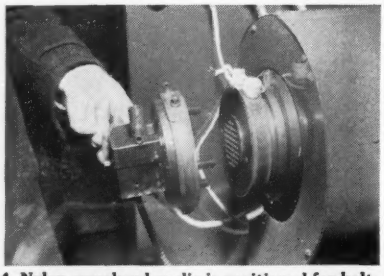
1. New standard 2½" electrically heated NRM Extruder, as furnished for general plastics materials. Two blowers provide balanced heat control.



2. Die gate swings open easily on hinges. The new front flange is split for easy removal.



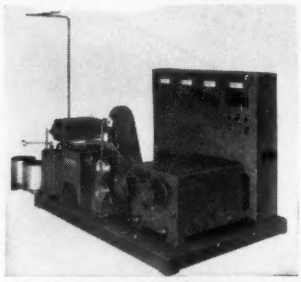
3. Standard die gate, subdie, strainer plate, and front end removed from extruder. Note cylinder heater shells and blower for balanced heat control.



4. Nylon crosshead or die is positioned for bolting directly to cylinder face. This avoids critical temperature variations from heat loss of flange.

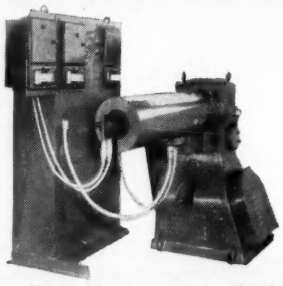
5. NRM Extruder set up for covering wire with Nylon. Wire is fed down through preheater to extruder. Covered wire is cooled in water tank under extruder head, is then ready for winding.

Self-contained Nylon Extruder



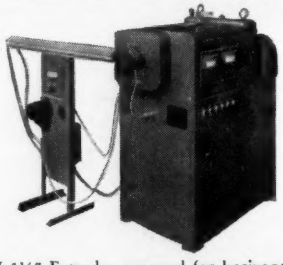
This 1" NRM bench model is a completely self-contained unit for Nylon covering of wire, sizes B & S Gauge #24 to #36. Unit includes electrically heated extruder, let-off, cooling tank, spark tester, dual capstan, dual take-up, and instrument and control cabinet.

Extrudes Nylon on steel ribbon



Wide application is characteristic of NRM Extruders. This 2½" model is used to cover a thin steel ribbon with Nylon to produce corset stays. In this unit feed is horizontal. Replacement of heads is simple matter.

Nylon Extruder with horizontal feed



NRM 1½" Extruder arranged for horizontal feed of wire through preheater. Only NRM Extruders provide balanced heat control, with absolute control over frictional heat. This feature is self-contained, requires no pipe connections for compressed air, oil, or water.

NATIONAL RUBBER MACHINERY CO.

General Offices & Engineering Laboratories
Akron 8, Ohio

PLANTS at Akron and Columbiana, Ohio and Clifton, N. J.
AGENTS East: National Rubber Machinery Co., Clifton, N. J.
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EXPORT Plastics Machinery: OMNI EXPORT CORPORATION
460 4th Ave., New York 16, N. Y.

Creative Engineering

Worried about the Wire situation?

● Each day, the mobilization program brings new and tougher problems for users of wire.

So *our* biggest job now, as we see it, is to help you solve these problems. And as the world's largest manufacturer of steel wire, we believe we can do it.

On our staff, we've got some of the best metallurgists in the world. They've worked on thousands of wire application problems. And—here's the best part—a problem that is new to you may be old stuff to our engineers. Maybe you're using a wire that's unsuitable for the job it has to do. No matter what your problem, our metallurgists are qualified to recommend the best type of wire for the application, and they are always ready to cooperate with you.

Anyway, if you're having trouble, it doesn't hurt to find out if we can help you.

This offer of free advice and help is nothing new. But we think you'll agree that this is a good time to repeat the offer.

UNITED STATES STEEL COMPANY
AMERICAN STEEL & WIRE DIVISION, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

AMERICAN MANUFACTURERS WIRE

AMERFINE—*High-quality fine wire.*

AMERSPRING—*music steel spring wire.*

AMERLOY—*alloy heading wire.*

AMERTEMP—*heavy-duty oil-tempered wire.*

AMERHEAD—*uniform heading wire.*

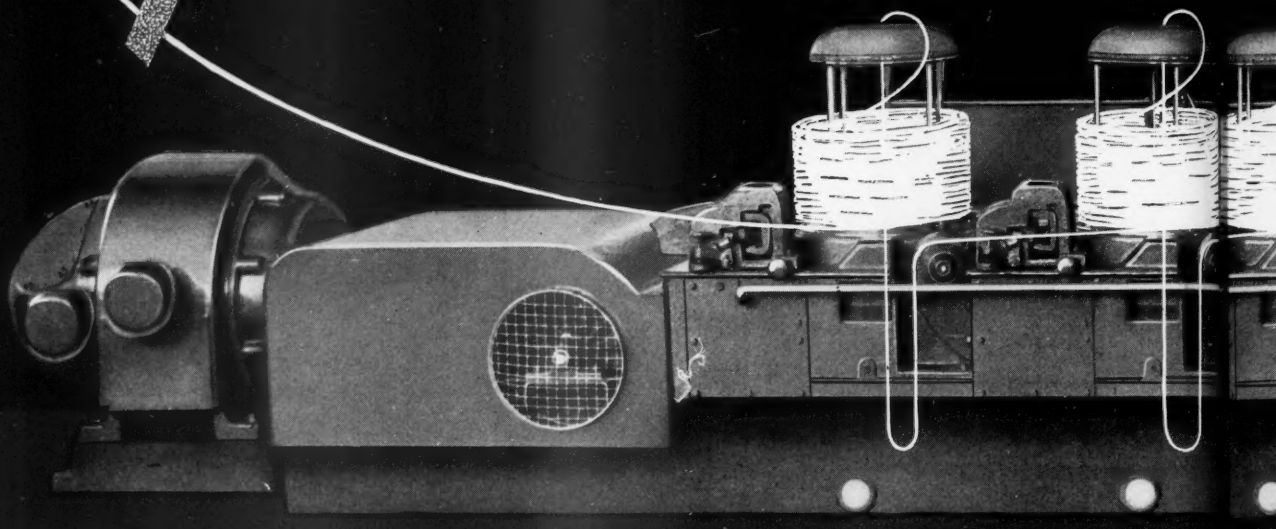
AMERSTITCH—*extra-tough metal stitching wire.*

U·S·S AMERICAN
MANUFACTURERS WIRE

USS

UNITED STATES STEEL

DRAW IT *Fast*...DRAW IT *Cool*



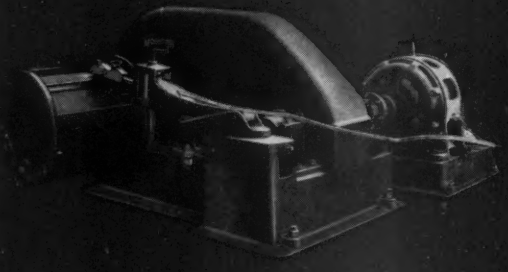
To draw rope wire at high speed and maintain necessary physical properties wire temperature must be reduced quickly.

Recent scientific tests prove the remarkable efficiency of the Morgan water oil cooling system. For example, drawing 6/0 rope wire at 1900 FPM finishing at 165,000 psi tensile

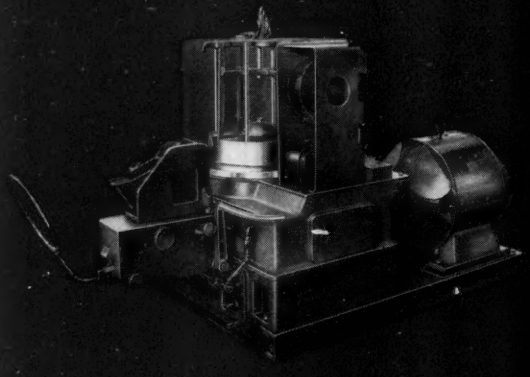
the average temperature of the wire leaving the die was 350°F.

Eleven seconds after leaving the die
the average temperature of the wire
was 200°F.

Will your machines do that?

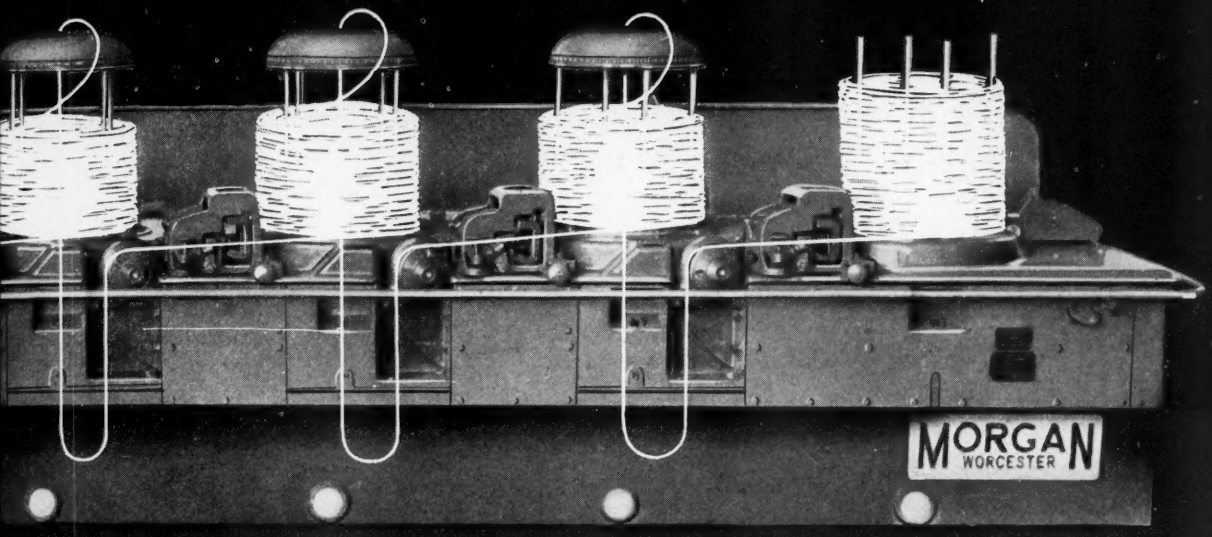


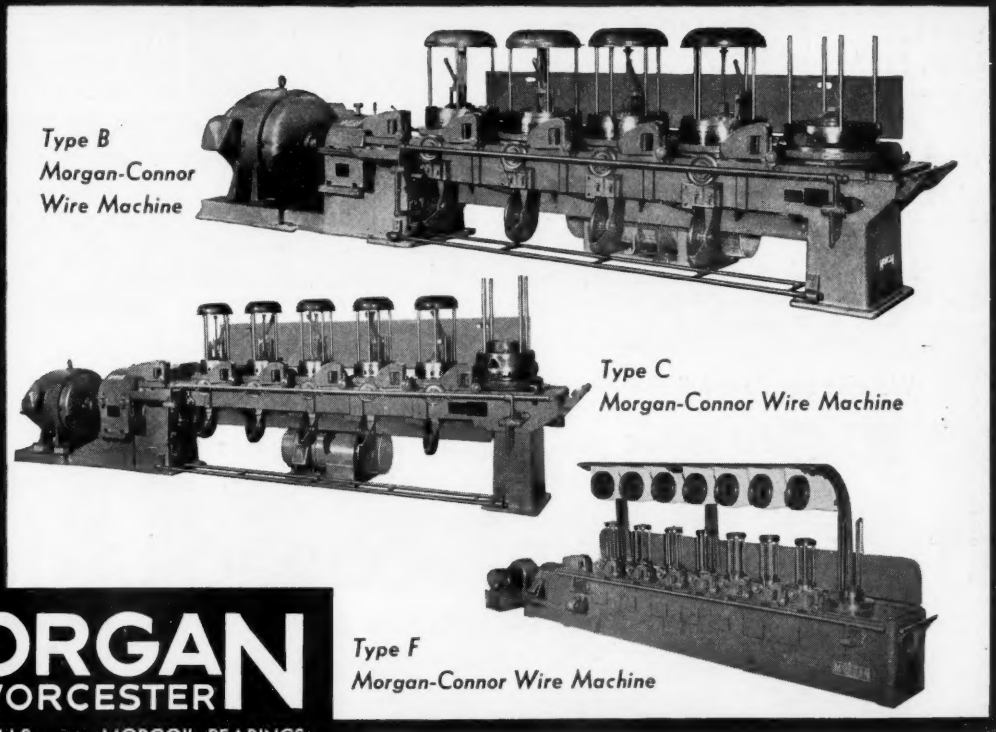
Morgan Horizontal Pull Block



The Morgan Wire

AN-CONNOR WIRE MACHINES





Type B
Morgan-Connor
Wire Machine

Type C
Morgan-Connor Wire Machine

Type F
Morgan-Connor Wire Machine

MORGAN
WORCESTER

ROLLING MILLS · MORGOIL BEARINGS
WIRE MILLS - GAS PRODUCERS - AIR EJECTORS
REGENERATIVE FURNACE CONTROL

Morgan Construction Co. Worcester, Mass.

PROPERLY DESIGNED DIES

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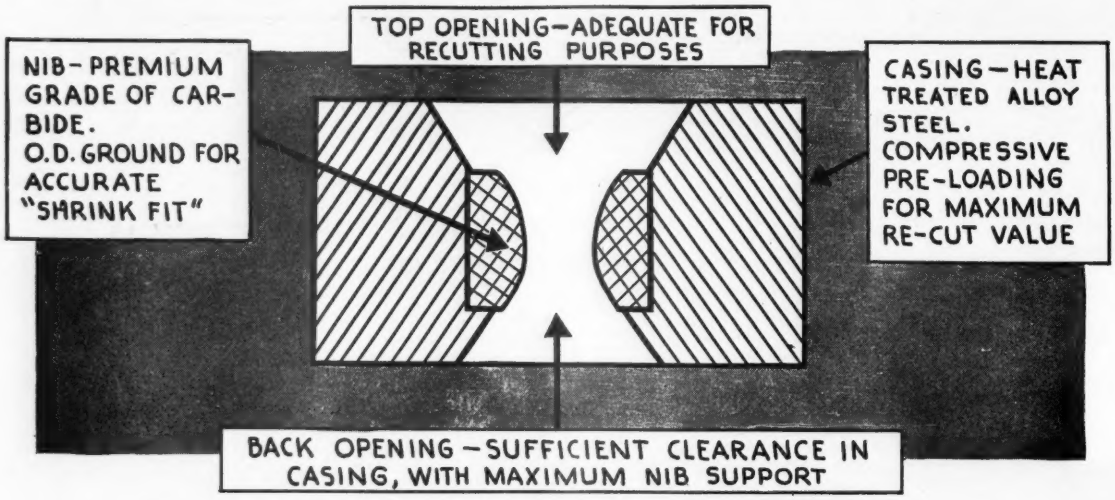
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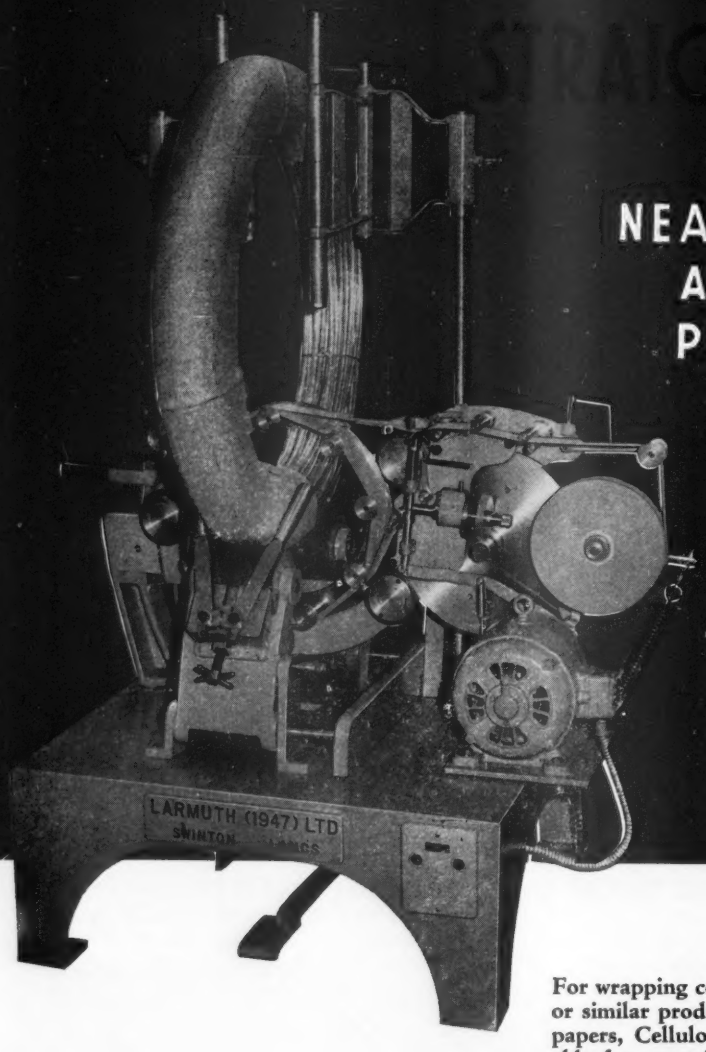

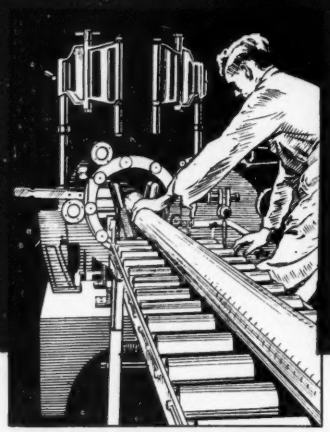

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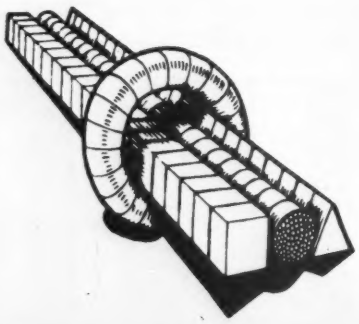

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REMEMBER Aesop's fable of the camel and his master--how the kind master allowed the shivering beast to put into the tent first his head, next his shoulders, then his forelegs!

And then the camel said, "Master, I think I ought to come wholly inside," and crowded in. Immediately he said, "There is hardly room for us both, so I think it would be better for you to stand outside so I can turn around and lie down." And without further ado, the camel kicked the man out and took the entire tent.

Men have heard this story for 2,500 years--repeatedly have seen how it illustrates what happens when one man or group of men gain power over others. Men saw it happen in Italy and Germany when Mussolini and Hitler took over. Men saw it happen in Russia.

Even here in America a similar trend is evident. Powerful influences overlook no opportunity, through political manipulation, central controls and bureaucratic regulations, to intrude more and more in our private lives. The situation demands continual, alert watchfulness by all citizens who believe in individual liberty and freedom, to prevent this camel of big government from creeping further into the tent. Before we realize it, "we, the people," the master, may find ourselves "standing outside." In America it is government, which is the servant of the people.

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The Wire Outlook

The start of a new year is traditionally a time for the reappraisal of personal and business circumstances.

As to the latter, industry seems to be largely over the readjustment hump and going strong with the production index up. Durable goods production is 20% higher than six months ago, although non-durables are off 3%, a natural result of the switch to a war economy.

During the first nine months the steel industry operated at 100.5% of its rated capacity and the full year will show an even higher figure. So far, nearly 10% more steel has been produced than in 1950 due to the absence of strikes and some expansion projects getting under way. Another factor that will bear heavily on the coming year's ability to maintain this pace will be the availability of scrap. Low scrap reserves are a source of constant worry to many steel companies.

1951 corporate profits are expected to be 15% to 20% under 1950 because of higher taxes, higher costs and resistance to high prices. Even lower profits are expected for 1952. Probably the condition will curtail spending for new plant and equipment expansions this year. Spending will be for equipment that will lower production costs.

Copper supply appears to be our most serious problem right now, with rather bleak prospects for the second quarter. The NPA says it may be necessary to cut off all civilian uses of the metal after March if current defense schedules are approved. Nickel will probably suffer the same fate. The end of the copper shortage is estimated differently. Government men see it extending into 1955, whereas copper producers expect there to be a small surplus in two years time. There are plenty of expansion projects on foot, but it takes time to get them into production.

However, strange things are happening in the midst of these shortages. Due to cut-backs in appliance manufacture, the case of one electric wire manufacturer was called to our attention in which they had not taken up 12,000 pounds of their allotment, because they had no use for the copper wire. Another instance is that of a zipper manufacturer who had ordered 50,000 pounds of brass wire, but cut it to 20,000 pounds before delivery. This product, incidentally, has been cut back to 35% of the base-period production. Non-ferrous spring production has been similarly affected. If the foregoing is a trend and if these examples are multiplied in hundreds of instances, the non-ferrous wire producers may shortly be facing the necessity of having to go out and sell again.

30,000 tons of lead was withdrawn from the military stockpiles in November to be sold to consumers on the basis of allocations. This was done to offset declining imports of lead.

The zinc supply is bothering those who make galvanized wire at a time when the demand for it is higher than ever. As domestic zinc production is as high as can be expected, there is no immediate prospect of improvement. The successful development of one of the several aluminum-coating processes being worked on may be the ultimate answer to the protection of steel through the use of coatings.

Some slackening in the demand for bolts, nuts and rivets has been noted, due to the curtailment of many consumer goods items. For the same reason high carbon steel wire is in better supply. Some soft spots in wire products have developed, not because of lack of demand, but due to government agency restrictions on uses.

While the outlook for 1952 has its uncertainties, it is far from unfavorable. In war times, we need controls, although the experience of this period and of preceding wars proves very clearly that a controlled economy is always fraught with inefficiencies and inequities—to say nothing of corruption, and the greater the control measures, the greater the confusion. It all goes to prove that no controlled economy can work. Russia will eventually fall when she has exhausted the possibilities of pillage, enslavement and exploitation, by which she has bolstered up a basically unsound system.

For 1952 a quickening tempo of business seems assured, as more and more business flows through the channels of mobilization.

—from the Editor's Desk

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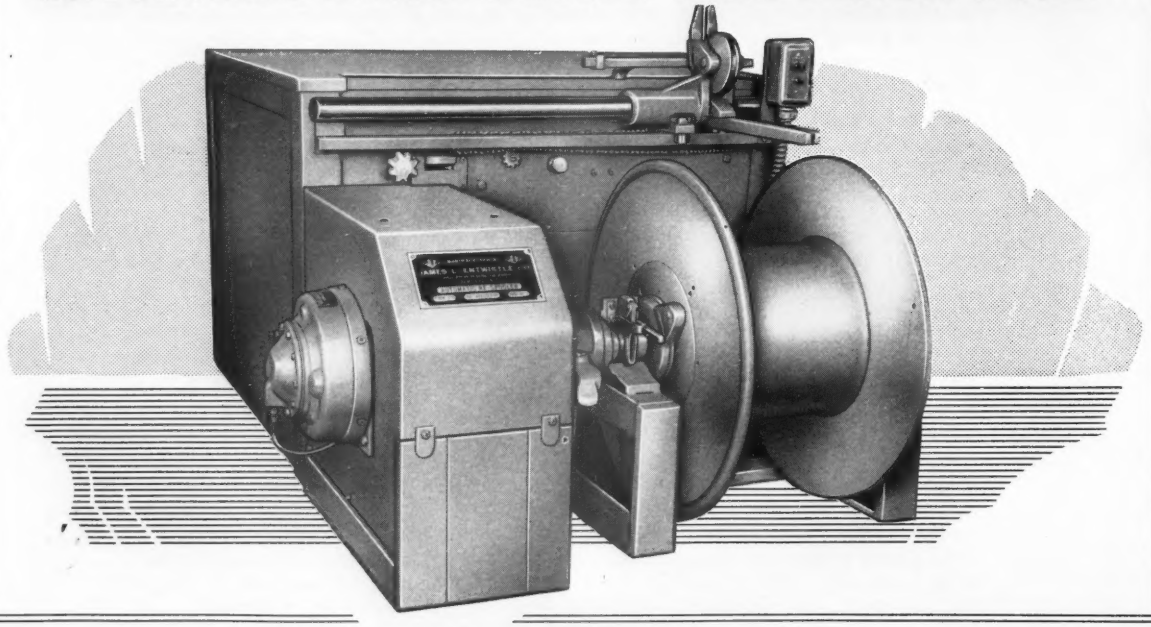

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See Page 69 for a complete listing of JLE Products for the Insulated and Bare Wire Industry.

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Vol. 27 JANUARY, 1952 No. 1

THE FABRICATION OF COPPER WIRE

By Sidney Rolle, Asst. Mgr.

The Scomet Company

New York, N. Y.

The Mordica Memorial Lecture

I Introduction

Mr. President, members and guests of The Wire Association, Ladies and Gentlemen:

★ ★ ★

First of all, let me say that I am deeply sensible of the honor the Board of Directors has paid me by selecting me, a non-ferrous man, to present the 1951 Mordica Memorial Lecture. **John Mordica,** as we all know, was a steel man and therefore it was only natural that when thought of the benefits which would be derived from an association of this kind, it would be in connection with ferrous wire. During the early days the membership of our Association was almost entirely made up of steel wire men but today, as our worthy Secretary tells me, 35 percent of the members are identified with non-ferrous wire activities—so with all due respect to tradition and the ferrous members of our association, we non-ferrous people have come of age. Nevertheless, I still feel that our Board has been most generous in having me talk on a subject which is somewhat apart from that in which John Mordica was interested. But when we speak of the non-ferrous wire industry, we must remember that it is wide and extensive. Besides, the fabricators and users of copper wire, there are included in this group fabricators of brass and other copper alloy wire, nickel and nickel alloy wire, aluminum and aluminum alloy wire and a few others. Of these the fabrication of copper wire is by far the most important and shall therefore devote this lecture solely to this branch of the non-ferrous wire industry. But before describing how copper wire is made today in up-to-date efficient mills, it might be well to outline what the entire lecture is going to cover; a synopsis of it follows:

(*See page* 37)

Copper and its alloys it is generally conceded, are one of man's most useful metals. Archeologists tell us that long before the dawn of history, the half-savage inhabitants of the Island of Cyprus, found some heavy old stones for making axes and spearheads. When hammered they bent, which made it possible to form them into all sorts of objects such as knives, axes, and tools. The new material was so useful that it became their choicest possession and in its honor they called it "Cyprian Metal" or Cyprium, in honor of their island home. Copper has kept this name through the ages in one form or another: in Latin it became "cuprum"; in English, "copper"; in French "cuivre"; in German "Kupfer". Cyprus was the most abundant source of copper in its native form for about 3000 years and when they no longer could obtain a sufficient supply of the reddish stones, they burned certain green stones with charcoal; in the ashes they found lumps of copper.

SIDNEY ROLLE

Mr. Rolle is a graduate of the School of Mines, Columbia University. After spending four years in South America as Engineer and Metallurgist for a copper company, he joined the United States Metals Refining Co., a subsidiary of The American Metal Company, Ltd., holding jobs successively as Draftsman, Engineer, Metallurgist and Business Manager. In 1930 he went with another subsidiary, The Scomet Company, of which he is at present Assistant Manager. He has been with The American Metal Company organization since 1910—a total of 41 years. He is an active member of the Wire Association, the American Institute of Mining and Metallurigcal Engineers, the Mining & Metallurigcal Society and the American Society for Testing Materials.

The work of compiling material for this lecture was a stupendous job and it contains much material of a valuable reference nature. At the end of this lecture is appended a bibliography of sources, indexed as to subject, which in itself may prove useful to others who may desire to delve more deeply into any of the points Mr. Rolle has covered. In the lecture as delivered at the Wire Association Convention, ninety slides were shown, but due to NPA restrictions on the use of electrotypes, only 30 illustrations are shown here.

IN MEMORIAM

JOHN MORDICA
1873-1937

This was one of the very first examples of copper smelting. We read that over 4000 years B.C. one of the Pharoahs wore a copper button of which he was very proud. Today this worthy metal is often spoken of with contempt: "Not worth a copper" generally means something of the lowest value. But today, the "red" metal (incidentally it isn't red at all—it's pale pink when viewed outside of contact with the air) has enormous value as you all know. Electricity is conveyed to our factories and homes by metallic wires through which flow streams of electrons just as water flows through pipes. How freely this electricity can flow or be conducted depends on what metal is used for the wire. It is here that copper comes to the front, for its low resistance to the flow of electricity. Its conductivity (which is the reverse of resistance) is almost as high as that of silver, which has the highest. But the copper must be pure; very minute amounts of some foreign elements will reduce appreciably the electrical conductivity. And here we come to the chemists and metallurgists who have done their part to give to the electrical industry a cheap metal having a purity of 99.95% copper. The first electrolytic copper refinery was erected in 1869 at Pembrey, Wales, and in the United States, the Balbach Smelting and Refining Co. erected a plant in 1883 in Newark, N. J. Today, in this country alone, there are 10 electrolytic copper refineries having a capacity of over 130,000 tons per month. 50% of the output of these refineries is in the form of copper wire bars, the name given to long 54 inch bars usually 4″ x 4″ in cross-section. The greater part of these wire bars is used for the production of copper wire. Not all copper wire is round, some of it being square, rectangular and of other cross-section. The chronological development of the use and production of copper beginning with the dawn of the Bronze Age, some 5,000 years before the metal was mined on the Island of Cyprus, is shown in Table I which follows:

CHRONOLOGICAL DEVELOPMENT OF THE USE OF COPPER

B.C.

8000 Probable dawn of the bronze age.

6000 Certain ores of copper, principally oxides smelted to produce metallic copper.

5000 Copper and tin mixed deliberately to produce bronze.

4000 Copper and bronze used extensively by the Chaldeans. The Egyptians discover how to draw wire through dies consisting of holes bored in hard wood.

3500 Copper tube used to carry water on the Cheops Pyramid in Egypt.

3000 Copper first mined on the Island of Cyprus.

2500 Copper and bronze used widely in Asia.

2000 Use of copper and bronze expands and increases.

1240 The Rio Tinto copper mines in Spain are seized by the Phoenicians.

1100 Indians of North and South America discover copper.

1000 Copper is produced by smelting sulphide ores. Brass is made from copper and cadmia, a zinc mineral.

280 The huge bronze statue, the Colossus of Rhodes erected.

250 The Carthaginians driven out of Spain by the Romans, who take over the operation of the Rio Tinto copper mines.

A.D.

166 Cyprus mines abandoned by the Romans. Note: These mines were reopened in 1922.

1320 The oldest existing copper roof in the world installed on the Cathedral at Hildesheim, Hannover, Germany.

1550 Copper ores are roasted before smelting and refining.

1752 Benjamin Franklin discovers that lightning is electricity using a brass key and a kite.

1769 James Watt invents the steam engine.

1800 Paul Revere becomes the pioneer copper fabricator in America. Supplies the brass cannons for the "Constitution."

1843 Samuel Morse invents the telegraph. Extensive use of copper wire begins.

1865 James Elkington invents the commercial electrolytic refining of copper.

1874 Alexander Graham Bell transmits first complete sentence over a copper wire.

1878 The incandescent lamp perfected by Thomas A. Edison.

1880 Flotation process invented.

1882 The first commercial electrolytic copper refinery built in Newark, N. J.

1882 Pearl Street electric light and power station is opened in New York.

1892 The first gasoline driven automobile is operated by Charles A. Duryea.

1896 Wireless telegraph—radio transmission is invented by Marconi.

1897 Wheel casting of copper shapes invented.

1902 Radio broadcasting and reception is accomplished.

1903 Wright Brothers make the first successful airplane flight at Kitty Hawk, S. C.

1907 Utah Copper Company starts operation.

1909 Peirce-Smith copper converter invented.

1931 First commercial large scale melting of copper in an electric induction furnace at Carteret, N. J.

1936 Melting of electrolytic copper in arc furnace developed at Copper Cliff, Ontario, Canada.

★ ★ ★

Fig. 1 shows how wire was made circa 1550. In the 18th century much of the wire was made by first cutting or slitting a sheet of metal and then drawing it through holes bored in a wooden block: this is illustrated in Fig. 2.

★ ★ ★

One of the earliest commercial uses of copper wire, and no doubt brass wire, was for carding wool—

Synopsis of Lecture

I. INTRODUCTION—SCOPE—STATISTICS

II. COPPER PRODUCTION

- **A. Mining**
  - 1. Early Practice
  - 2. Modern Methods
- **B. Smelting**
  - 1. Early Practice
  - 2. Modern Methods
- **C. Refining**
  - 1. Fire Refining
  - 2. Electrolytic Process
    - Anode Casting
    - Electrolysis
    - Wire Bar Casting
      - Horizontal Bars
      - Scalped Bars
      - V. C. Bars OFHC Bars

III. FABRICATION OF COPPER WIRE (Circular Cross Section)

- **A. Heating Wire Bars**
- **B. Hot Rolling Bars into Wire**
- **C. Drawing Practice**
  - 1. Pickling and Washing
  - 2. Machine Practice
    - (a) Design of Machines
      - Dies
        - Tungsten Carbide
        - Diamond
      - Mechanical Details
    - (b) Speeds
    - (c) Lubrication
    - (d) Annealing
      - Batch
      - Continuous
    - (e) Backpull (Reaction Drawing)
- **D. Specifications (A.S.T.M.)**

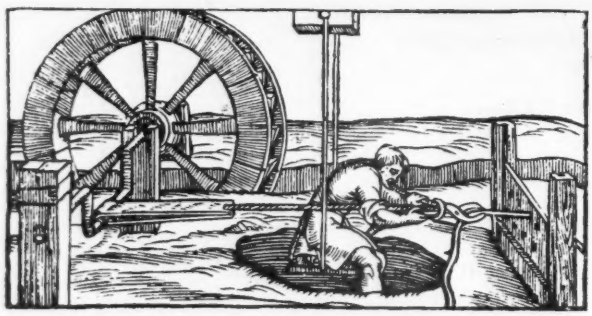

Fig. 1—Wire Manufacture in the 16th Century: wire being drawn through holes in block by means of water power.

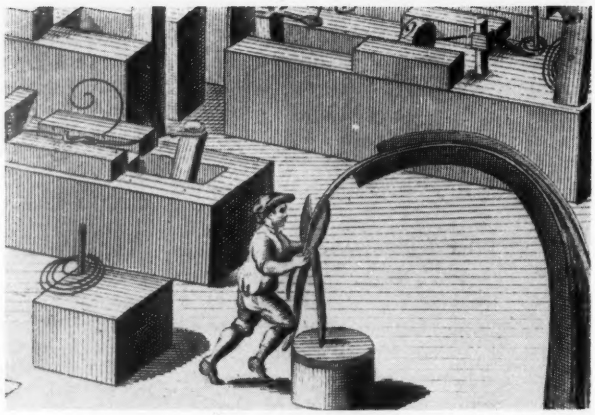

Fig. 2—Bare size wire being made by cutting a strip from a sheet circa 1772.

the process in which the long woolen fibres required for production of worsteds were combed and the short fibres carded. A card was a wooden instrument with a handle on one side of which were wire teeth set in leather. The wool was placed between two cards which were then worked by hand in every direction to produce a mass of interlaced fibres, which were then sent to the spinners. Later, in the 18th century, the carding was done by machinery.

★ ★ ★

Just when copper was first drawn into wire is not quite certain, but it is generally believed that it was done for the first time at Nuremburg, Germany, in the 14th century. In the beginning the wire was pulled through the dies by hand, but later machinery driven by water or other power was used. About the middle of the 17th century a wire mill was established in England for producing wire from copper imported from Sweden. The mill, with its 24-wire drawing benches worked by water power, produced a ton of wire a week.

★ ★ ★

And here is another interesting historical note: at the end of the 18th century Great Britain produced about 75% of all the copper produced in the world. Most of this came from the Cornish mines, all of the ore being smelted and refined in Swansea, South Wales. How times have changed—today, Great Britain has no copper mines of importance and its requirements for copper have to be supplied from abroad.

★ ★ ★

In any discussion of the early development of the copper industry one must not omit two important events. First—the introduction of water power in about the 18th century to drive all sorts of machines in the mines and smelters. Second—the invention of the steam engine by Watt in 1769, which many consider the beginning of the Industrial Age. One of the earliest use of Watt's steam engine was for driving pumps in mines in England and Wales. And speaking of Wales, smelting of copper ore was started in that country about 1580. At first they only treated copper ore coming from the Cornish mines, but later ores from all parts of the world were smelted there and as a result, South Wales became the copper smelting center of the world, despite a position which it held until about the middle of the 19th century; this despite the fact that copper mining in Great Britain had begun to decline by about 1840. As late as 1910 the United States Metals Refining Company Copper Refinery in Carteret, N. J., had men on the payroll who had obtained their training in Wales.

★ ★ ★

I would like to call your attention here to some interesting statistics. Table II shows how the world production of copper has increased from the beginning of the 19th century to date. I am indebted to my good friends, **Herbert J. Miller,** of the British Insulated Callender's Cables, Ltd., Prescot, England, for this compilation. Table III gives some interesting copper statistics for 1950.

★ ★ ★

The rapid development of mining, smelting, and refining of copper in the United States is something of which we Americans can be justly proud. We owe much to the early work done in Great Britain, Germany, and other European countries but the idea of large scale operations utilizing mechanical devices of all kinds is largely, if not entirely, American in origin.

Table II.

World Production of Copper by Decades

Decade	Production Tons 2000 lbs.
1801-1810	182,000
1811-1820	188,496
1821-1830	273,504
1831-1840	364,448
1841-1850	493,808
1851-1860	759,079
1861-1870	1,149,344
1871-1880	1,423,744
1881-1890	2,488,591
1891-1900	4,149,353
1901-1910	7,628,334
1911-1920	12,187,341
1921-1930	15,198,926
1931-1940	18,060,001
1941-1950	26,064,120

Table III.

COPPER STATISTICS FOR THE YEAR 1950

Total World production from ores

	Tons 2000 Lbs.	Per Cent
Total North & South America	1,701,623	61.9
Total Europe*	125,620	4.6
Total Asia*	116,876	4.2
Total Africa*	557,032	20.-
Total Australia	17,540	.6
Total Russia*	240,000	8.7
Total	2,758,751	100.

*Estimated in part.

U. S. Refinery Output of Copper Including Fire Refined

	Tons 2000 Lbs.
Cathodes produced	1,249,021
Shapes produced from other than Cathode	157.595
Total refinery prod.	1,406,616

★ ★ ★

The scientific discoveries and inventions of Galvani, Volta, Davy, Faraday, Ampere, Morse, Edison and others in the field of electricity are so well-known they need not be detailed here; however, nearly all these developments had something to do with copper. But the great interest which the world took in electrical matters began about the beginning of the 19th century, and there is no doubt that the rapid progress of electrical engineering has been due largely to the existence of copper.

★ ★ ★

And in turn, while the many and rapid developments in the electrical industry created ever-increasing demands for copper wire, this industry was one of the major factors in developing the cheap commercial production of steel wire by providing electric power to wire drawing machinery.

II. Copper Production

Although the subject of this lecture is the fabrication of copper wire, I should like to tell you a little about the processes preceding the work usually done in the wire mills.

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Fig. 3 gives a picturesque presentation of the entire process from ore to the end products of the refineries. For this I am indebted to the WESTINGHOUSE ENGINEER, a house organ of the Westinghouse Electric Corporation.

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Later I'll show you two flow sheets of modern electrolytic copper refineries; the first is that of the general run of refineries and the second that of the United States Metals Refining Co. at which the engineers and metallurgists have modified the last stages of the process to produce oxygen-free high conductivity copper.

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In the production of copper wire, there are four stages which precede the rolling of the rod and wire drawing. These four are—Mining, Concentrating, Smelting, and Refining. The first of these, Mining, has today reached a remarkable stage of development. For example, in the great open-pit mine of the Utah Copper Company, one of the subsidiaries of the Kennecott Copper Corporation, about 86,000 tons of ore, containing about 0.95% of copper are mined each day. Another great mine is the one in Chuquicamata in Chile, South America, belonging to the Anaconda Copper Mining Co. In 1950 the average daily production at the large open-pit mine of Phelps Dodge Copper Co., at Morenci, Arizona, was 50,000 tons; the average grade of the ore was 1.16% copper.

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The total U. S. production of copper in 1950 was about 900,000 tons, about 39% of the world production. At present, nearly 75% of the United States production of copper comes from open-pit mines. The average grade of the ore is only about 1%, that is, 20 pounds of copper per ton of ore. A century ago, the ore mined contained about 20% of copper, or 400 pounds per ton.

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Second and Third Stages: These are Concentrating and Smelting. As was shown in Fig. 3, the entire process, the ore after being concentrated, that is, the gangue removed, is smelted in large furnaces and converted to produce blister copper, the term used to define the impure copper coming from the converters. This impure copper must be refined before it can be used in the fabrication of commercial shapes, such as billets, cakes, ingots, and wire bars.

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Fourth Stage: Now we come to Re-

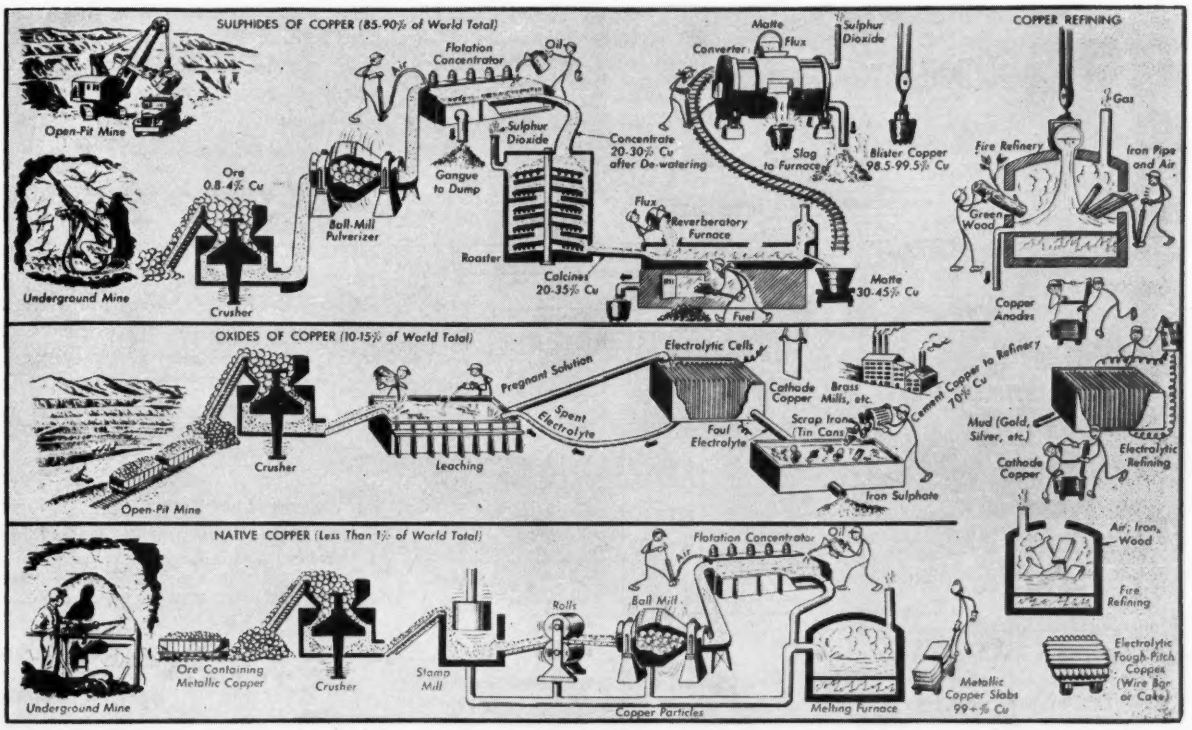

Fig. 3—A pictorial representation of the various steps taken in making copper wire and other shapes from the ore. * * * * *

FLOW SHEET OF A MODERN ELECTROLYTIC COPPER REFINERY

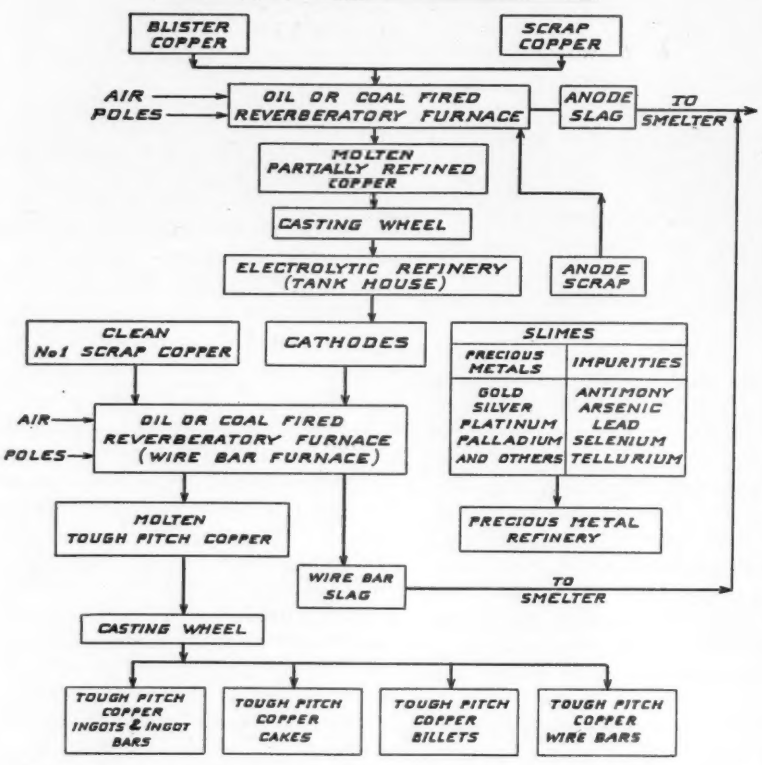

Fig. 4—

FLOW SHEET OF THE ELECTROLYTIC COPPER REFINERY OF THE UNITED STATES METALS REFINING CO. AT CARTERET, N.J.

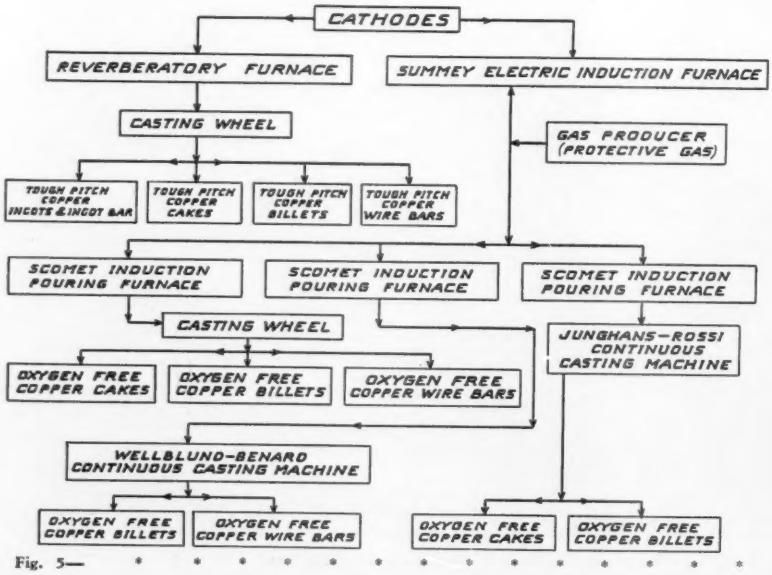

Fig. 5—

fining, about which I'll speak somewhat more at length because it is of particular importance in obtaining wire bars of the quality required by the rod mills for rolling into high quality rods. I say this because it is now well recognized that it is very difficult—if not impossible—to produce a good rod from a wire bar which is defective in one way or another. Of course, it is not difficult to make a defective rod from a perfect wire bar. All intermediate products must be as good as possible in order to turn out a flawless finished end-product, which in our case is wire.

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In the United States practically all copper is refined electrolytically whereas in Great Britain which has only a few small electrolytic refineries, nearly all the copper is fire-refined. This has been possible only because the blister copper is of such composition as to make it possible to remove the impurities contained in the blister copper without electrolytic refining. About 85% of the world's production today is electrically refined, of which about 5% is not melted, but sold in the form of cathode copper. About 15% of the world production today is fire-refined, but of this, about 9% is not used for purposes where high electric conductivity is required. We see from these figures that when we speak of refined copper, we usually mean electrolytic copper.

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Fig. 4 shows the flow sheet of a typical electrolytic copper refinery. At the U. S. Metals Refining Company plant in Carteret, N. J. (subsidiary of The American Metal Company, Ltd.) modifications have been made in the melting of the cathodes coming from the Tank House: the flow sheet of that refinery is shown in Fig. 5.

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Electrolytic copper refining consists of the following basic steps:

1. Melting the blister or other form of impure copper in a reverberatory furnace and partially refining it by slagging off some of the impurities; certain elements such as bismuth cannot be removed in this manner. Likewise the precious metals such as gold, platinum, palladium and silver are fortunately also not removed by this fire-refining process.

2. Casting the molten impure copper into forms called anodes which usually are

Fig. 6—Casting anodes at United States Metals Refining Co. Plant, Carteret, N. J.

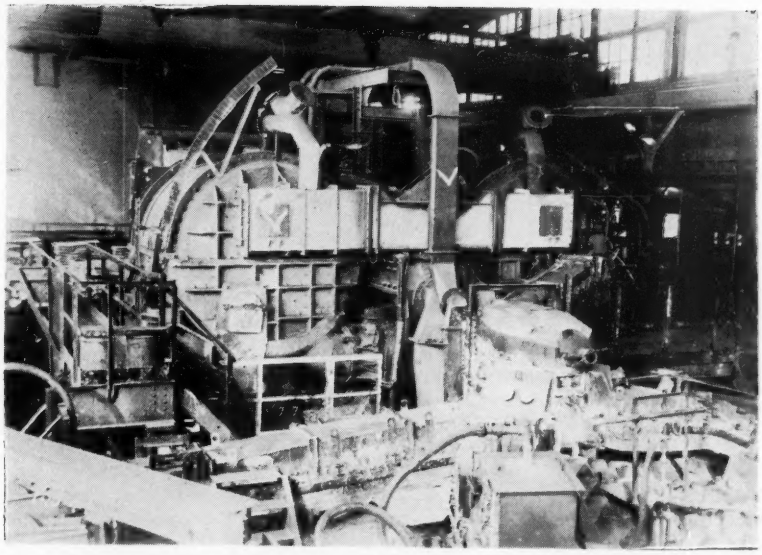

Fig. 9—Large electric induction furnace at Carteret, N. J. used in production of OFHC copper.

square shapes about 3 ft. x 3 ft. by 1 inch thick.

3. Placing the anodes in a lead lined tank in which there is a circulating solution of copper sulphate and dilute sulphuric acid, called the electrolyte, and inserting a thin sheet of electrolytic cathode copper, called starting sheets, between each anode.

4. Passing a direct current of electricity from the anodes through the solution to the starting sheets. All of the anodes in one tank are connected to form the positive pole and all of the cathodes are connected to form the negative. This is called the multiple system of connection. It is the one commonly employed in all electrolytic refineries.

As a result of the passage of the electric current the copper in the anodes is gradually dissolved and deposited on or around the starting sheets to form a thick deposit, called the cathode. Practically all of the precious metals drop to the bottom of the tank, as do some of the impurities such as antimony, arsenic lead, selenium and tellurium. The cathode deposit is pure containing about 99.97-99.99% copper. The balance of the impurities, the soluble ones, such as nickel, go into the electrolyte.

5. The cathode copper plates about 3 ft. x 3 ft. x ½ inch, each weighing about 250 pounds, are then melted in some form of furnace. Common practice is to use reverberatory furnaces very similar to the ones used for melting blister copper, that is, the anode furnace. About 20 years ago, work was started on melting cathodes in electric furnaces. The first to succeed in carrying this out in a large scale was D. L. Summey whose large 2250 Kw induction furnace was installed at the U. S. Metals Refining Co. plant in Carteret, N. J. A few years later, a large arc-furnace of the Heroult type was put into operation at the International Nickel Co. refinery in Copper Cliff, Canada.

6. Casting of copper is carried out in a number of ways. The great bulk of electrolytic copper, especially wire bars, is cast in open-tray horizontal molds. This copper when cast is called tough-pitch copper—a term which probably originated in Wales. It is the name given refined copper which contains, outside of the set surface, about 0.035% oxygen in the form of cuprous oxide. Tough pitch copper is also cast in vertical water-cooled copper molds. With this method, the area of the set-surface is greatly reduced and the resulting castings are of better quality. However, only a small percentage of the total production of wire bars is in this form. If it is desired to have a tough-pitch wire bar without the set-surface, which consists largely of cuprous oxide, this can be accomplished by planing off or scalping this upper surface.

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Fig. 6 shows how anodes are cast at the U. S. Metals Refining Co.

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Fig. 7 shows the charging of cathodes at the International Smelting and Refining Co. plant (Raritan Copper Works) at Perth Amboy, N. J.

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Fig. 8 shows the various shapes in which copper is cast at Carteret,

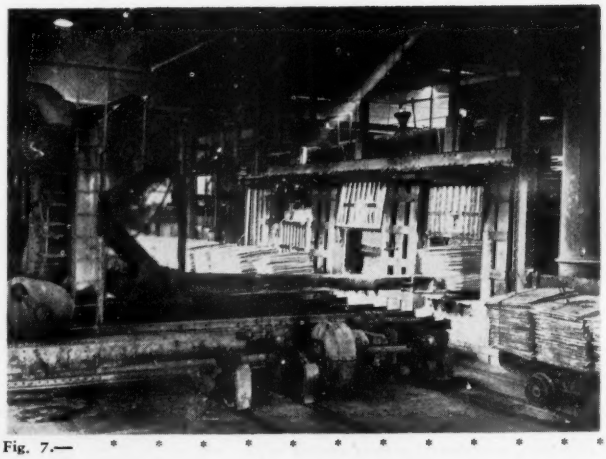

Fig. 7.— * * * * * * * * * * * * *

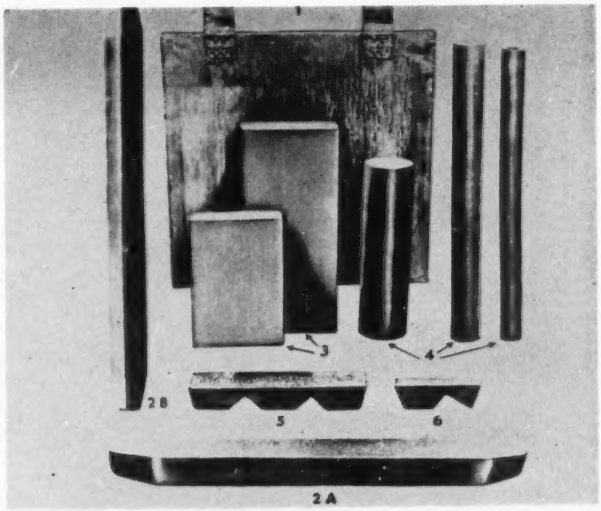

Fig. 8.— * * * * * * * * * * * * *

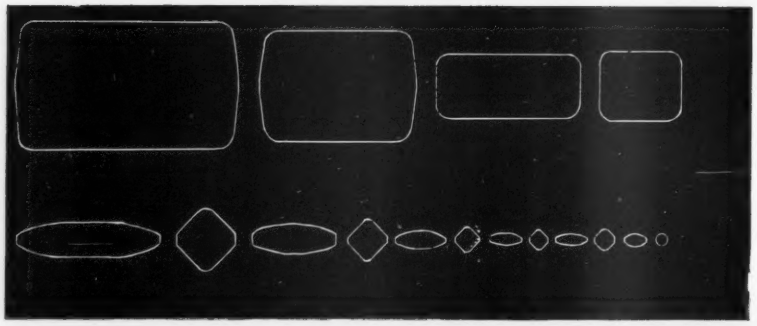

Fig. 10.—

New Jersey.

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The large electric induction furnace in the OFHC Department at Carteret is shown in Fig. 9.

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Macro-structure of Tough Pitch Horizontally Cast Wire Bars having an average density of 8.50 is shown in Fig. 10.

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Fig. 11 shows the macro-structure of OFHC Vertically Cast Wire Bars, the average density of which is 8.92.

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A typical analysis of wire bars produced in the United States is shown in Table IV.

Rod Rolling

The next step in the fabrication of copper wire is hot-rolling the wire bars coming from the refiners. The literature on this phase of production is not extensive, largely because the industry is not widespread. However, I am proud to say that the official publication of our Association WIRE AND WIRE PRODUCTS, contains more articles on this subject than any magazine or technical society publication in the world.

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Table IV

Typical Analysis of Electrolytic Copper Wire Bars

Element	Per Cent
Copper	99.95
Antimony	0.0005
Arsenic	0.0005
Bismuth	Trace
Iron	0.0020
Lead	0.0010
Nickel	0.0015
Oxygen	0.0350
Selenium	0.0002
Silver	0.0012
Sulphur	0.0015
Tellurium	0.0001
Total Impurities	0.0435
Electrical Conductivity	101.00

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The first step in hot rolling is heating the wire bars in a gas or oil-fired furnace. The wire bars are usually taken from the storage space and piled near the back end of the furnace, where a jib crane leads them on to the furnace pusher platform. The bars usually remain in the furnace for about 60 minutes and then discharge at the front end where they are dropped onto a roller table. Tough pitch wire bars require a temperature of about 1650 degrees F (899 degrees C): oxygen-free copper requires a somewhat lower temperature. When tough pitch copper is being melted for rolling, the atmosphere in the furnace is usually

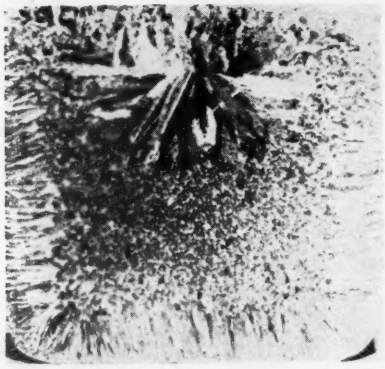

Fig. 11.—

Fig. 12—Roll passes at one of the large rod mills.

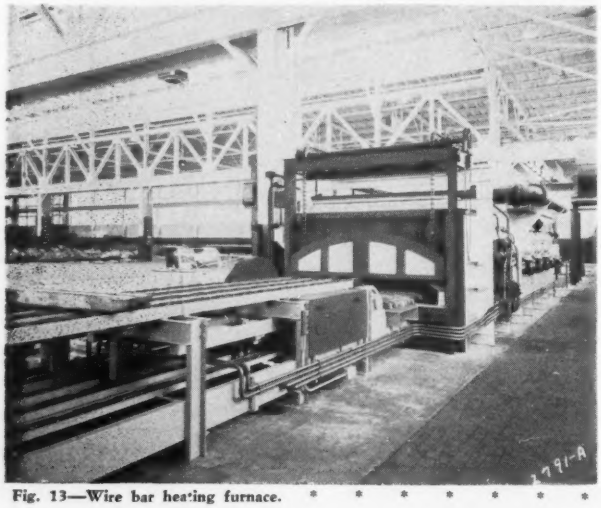

Fig. 13—Wire bar heating furnace.

Fig. 14—Front view of a large modern rolling mill.

neutral to slightly oxidizing whereas when heating oxygen-free copper bars, it is necessary to maintain a slightly reducing atmosphere. A good heating furnace will handle 95 to 100 wire bars per hour.

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Time will not permit me to give you the full details of the procedure followed in modern copper rod rolling mills. This procedure differs from mill to mill. A few mills are automatic requiring a few men to operate while at others where nearly all the looping is done by hand, many men are needed. The fully automatic mills have not always been found economic especially when changes have to be made in the size of the finished rod.

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In general, the practice in this country in the fabrication of circular cross-section wire is to roll the 4 x 4 wire bars to 5/16 inch diameter rod in 16 or 17 passes. This is, so to speak, done in three stages with no break between stages. The first stage is the breakdown usually 5 to 7 passes. The second, the intermediate usually 5 to 6 passes, and third the finishing—5 to 6 passes. The breakdown rolls are usually 3 high and the others 2 high mills. At one of the modern mills, the intermediate and finishing trains are set up in one line of 9 stands, 5 intermediate and 4 finishing. Each unit is driven by a synchronous motor direct connected to the pinion stand. These mills are all 3 high but mount only two rolls. From the 1st to the 7th pass and from the 8th to the 11th pass the rod is handled automatically, but from the 12th to the 16th it is caught, looped and fed by hand.

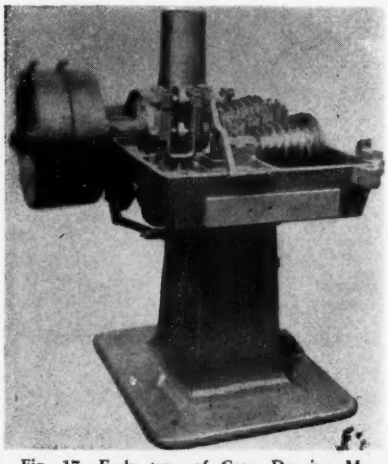

Fig. 17—Early type of Cone Drawing Machine. Circa 1900.

Fig. 15—Filing a butt weld.

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The rolls most often made of chilled cast iron are mounted in roller bearings and connected to their pinion stands by Universal spindles.

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A good modern mill will produce from 25 to 30,000 pounds of 5/16 to 3/8 inch diameter rod per hour.

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The following figures which are shown below will give you some idea how hot-rolling is carried out in some mills.

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Fig. 12 shows how the roll passes at one of the large rod mills; unfortunately the outline of the 4 x 4 wire bar is not shown. The first reduction is about 45%.

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A view of a modern wire bar heating furnace is shown in Fig. 13.

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Fig. 14 shows the front view of one of our large modern rod mills.

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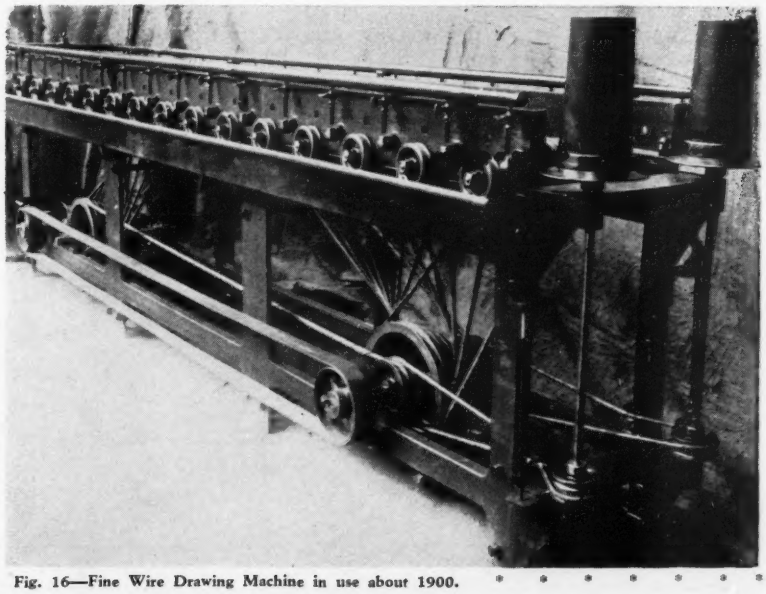

Fig. 16—Fine Wire Drawing Machine in use about 1900.

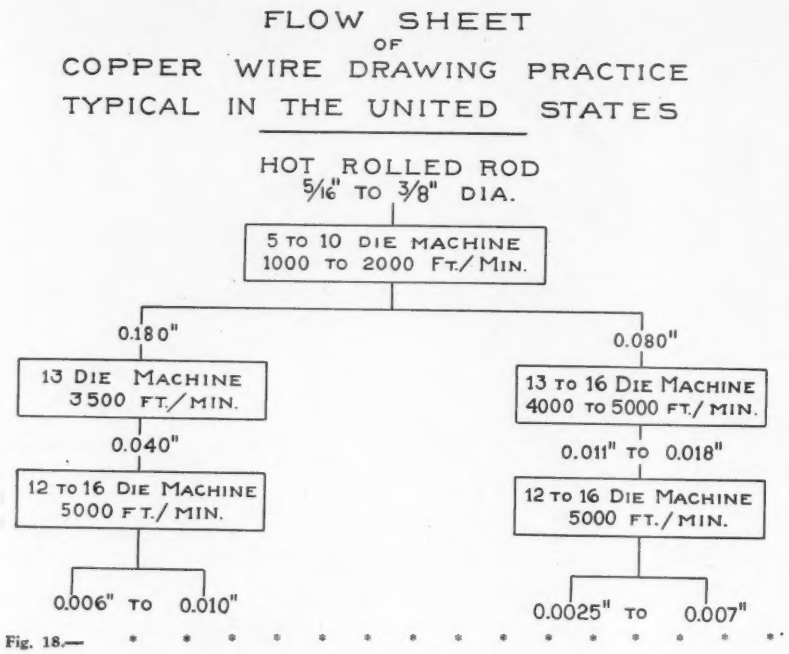

Fig. 18.—

Pickling and Washing

When the coils or rod are allowed to cool slowly, a film of cuprous and cupric oxide forms on the surface which must be removed before wire drawing is begun. This is customarily done by pickling, that is, immersing the coils in a dilute solution of sulphuric acid. This acid is in turn removed by washing in hot water. This operation is important, especially with oxygen-free copper, because the film of oxide adheres more firmly on this type of copper than on tough pitch copper. The rod is hot enough to cause the moisture to evaporate so that when the coils are stacked they are quite dry. At this state the rod should be pink, clean and entirely free of scale.

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Shaving

For special types of wire, which must be of the finest quality, the rod is often shaved. Only a very thin sliver about 0.008 inches is removed in this operation. For ordinary purposes, shaving is not necessary, when the rod is rolled in the proper manner. Shaving is done at about 250 ft. per minute.

Welding

The coils of rod weighing 250 pounds are too small in weight and corresponding length for the ordinary coils going to the wire mill. Accordingly, the rod coils are welded together in electric butt-welding machines. When long lengths are required, a number of coils are welded in this manner.

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Fig. 15 shows a welder joining the ends of two coils at one of Western Electric Company's plants.

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Wire Drawing

And now we come to the actual fabrication of copper wire, that is the drawing. Up to about 1900 all steel wire as well as copper was still drawn through single holes punched in a steel plate. Single lengths of wire were drawn through rows of holes by power-driven capstans, and as each reduction was made, the steel plate die had to be replaced by another having a smaller hole, or the wire was shifted from one hole to another in the same plate. Why this method was expensive and not productive of good quality wire is obvious. Departure from the single-hole wire drawing came about 1900 when multiple die machines were first introduced.

Practice 1900 to 1920

The early multiple die machines were very slow in comparison with modern ones; heavy-duty machines finished wire direct from rod in one operation, but at a speed of only about 250 ft. per minute. The lighter machines operated on inlet wire below about 0.08 inches diameter and finished at 0.16 inches upwards. These types of machines continued

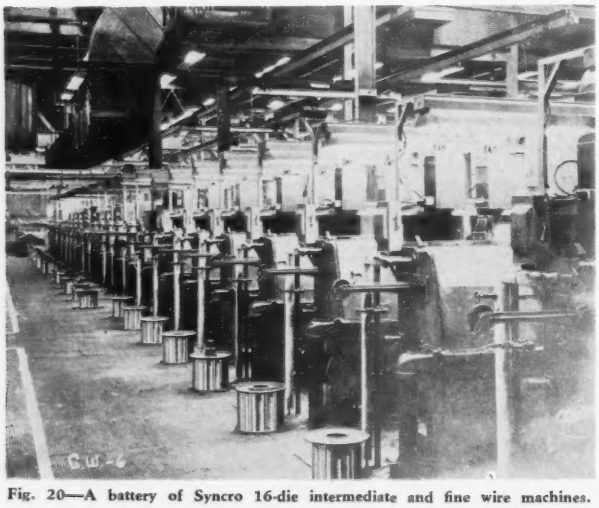

Fig. 20—A battery of Syncro 16-die intermediate and fine wire machines.

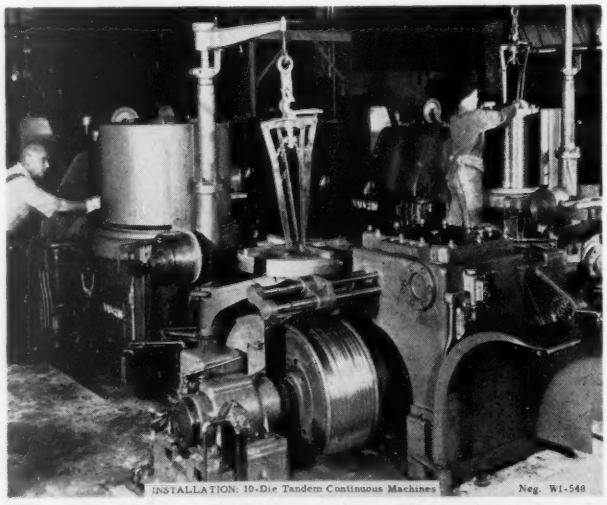

Fig. 21—Two Vaughn 10-die Tandem Continuous Machines for drawing rod.

to be used for many years and the only important improvement was in an increase of the drawing speed to about 350 ft. per minute. Figs. 16 and 17 show two wire drawing machines in use before 1900.

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Practice 1920 to 1930

It was not until the advent of the tungsten carbide die that higher speeds in wire drawing became possible. One might say that this small piece of equipment revolutionized the machines and methods used in drawing those gauges of wire which did not require diamond dies.

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During this period drawing speeds were continuously increased and by 1930 wire drawing equipment manufacturers had developed tandem and cone type machines capable of finishing copper wire up to about 2000 ft. per minute. During this period tungsten carbide dies were also being improved so that their life was greatly increased. This in turn brought about improvements in wire drawing practice such as welding together a number of rods or wire to form long lengths. Many other improvements in wire drawing practice, such as better lubricants and better handling, were begun in this period.

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Present Day Practice

Having devoted somewhat too much time to my introduction and to the procedures leading up to the drawing of the wire, I shall have to be very brief in describing present day copper wire drawing practice. Fig. 18 shows the flow sheet of what may be considered typical of current wire drawing practice in the United States. I have been informed that at a mill which has not been in operation very long, the 5/16″ diameter rod goes to a 13-die machine which draws down to .061″ at a speed of 3500 ft. per minute. By making further modification they hope to draw down to .045″. From this machine, the wire goes to a 12/16-die machine which draws it down to .008″ at a speed of 5000 ft. per min. The general practice in the copper industry is to use tungsten carbide dies from the largest sizes down to 0.057 inches (#15 AWG): some mills use them down to 0.040 inches (#18 AWG). Diamond dies are employed from about 0.064 inches (#14 AWG) down to the finest sizes.

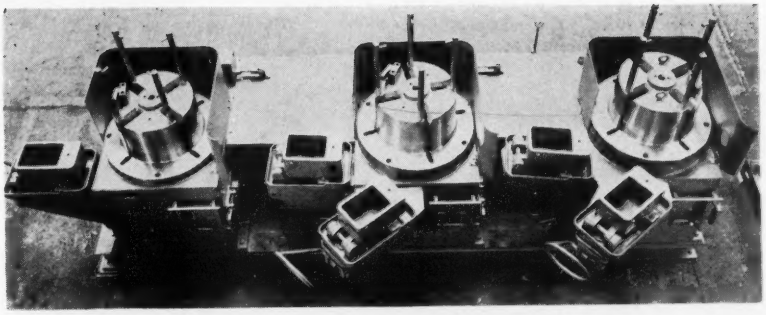

Fig. 19—Syncro Machine Co. heavy wire three block draw bench. * * * *

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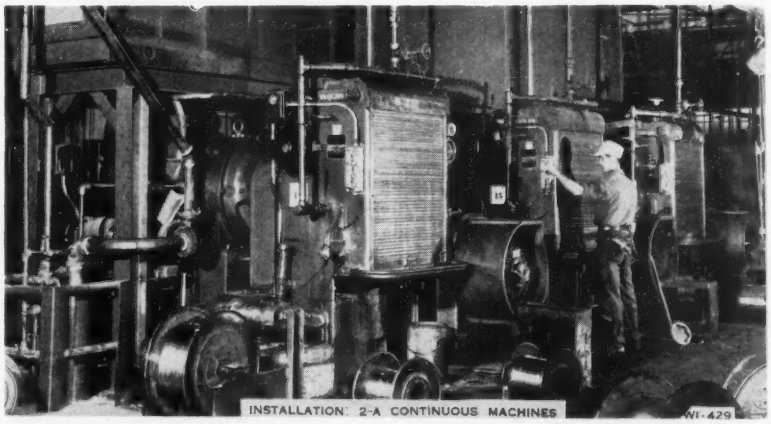

Fig. 22—Battery of three Vaughn 2-A continuous machines. * * * * * *

Too much cannot be said about the necessity of using correctly shaped dies. The literature on the subject is replete with excellent technical articles. Many of these have been in the form of papers

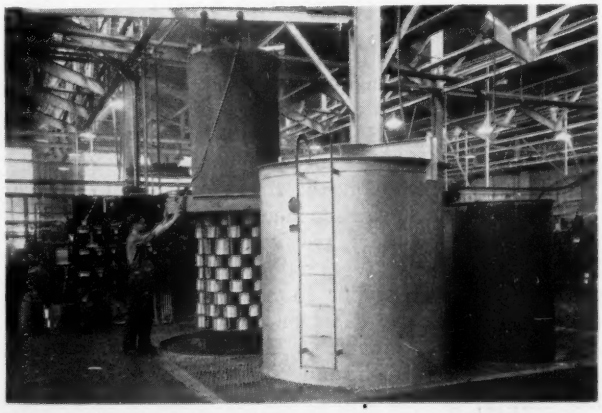

Fig. 23—General Electric Bell-type electric furnace for annealing copper wire on spools.

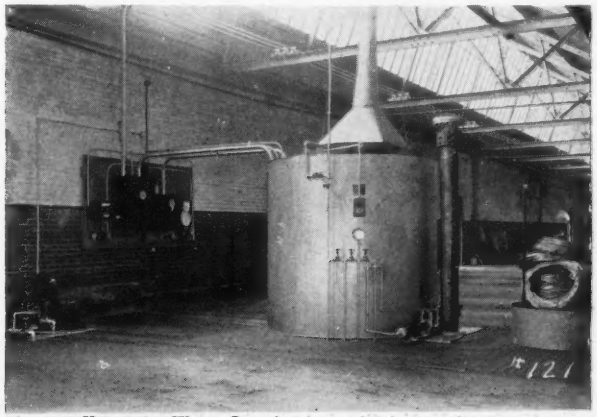

Fig. 24—Kenworthy Water Quench, single chamber rotating type furnace.

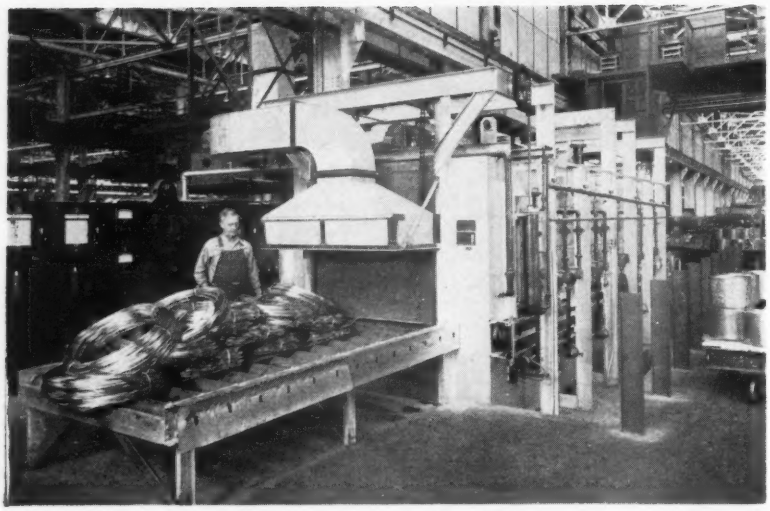

Fig. 25—Electric Furnace Co. Direct Gas Fired Semi Continuous Annealing Furnace. * *

presented at meetings of our Association. It has been clearly demonstrated that improperly designed dies make it impossible to work the metal uniformly throughout its cross-section. As long ago as 1930, H. C. Jennison pointed out in a paper read before the American Institute of Mining and Metallurgical Engineers that if the die angles are too great, then the cold-working effect is not transmitted to the center with the result that the rod or wire is heavily worked at the surface while the interior portion is under-worked. This condition is likely to develop into internal fractures, commonly termed "cup-and-cone fractures". When the die angles are small, excessive friction develops resulting in high power consumption, bad surface, and possibility of the wire breaking.

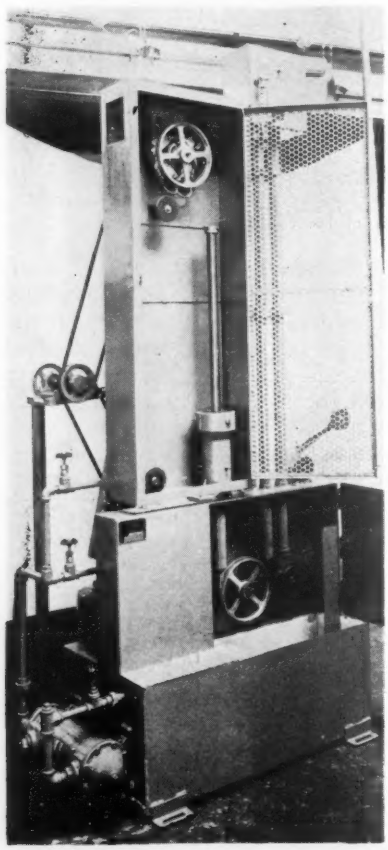

Fig. 26—Syncro Machine Co.'s Resistance Annealer with heat exchanger mounted on side.

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The "bearing" length, which is largely dependent on the frictional effect between the metal and the die is also important. The bell angle seems to be less important; the back relief must be sufficient to take care of the expansion of the wire as it leaves the die.

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There is no question but that the introduction of tungsten carbide dies has been the outstanding single contribution to the improvement in wire drawing practice. The early dies often were porous and were generally of variable quality. This porosity caused die loading, especially when drawing a soft material such as copper. Today, due to improvements in the method of manufacturing, especially in the sintering process, dense tungsten carbide dies of excellent quality are readily available to the wire drawer. As previously mentioned, diamond dies are used for the finer sizes, that is, from 0.064 inches (#14 AWG) and down.

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Drawing

The usual practice in the United States is to draw according to the Brown and Sharpe Gauge System (American Wire Gauge) and nearly all machines are designed for it. Each draft in this system is one number, that is, a reduction in area of 20.7 per cent. While this simplifies the procedure greatly, the total work performed in a particular machine is not as great as it might be when drawing copper. With a ductile metal such as copper, which is capable of withstanding much cold working, it has been found unnecessary to resort to intermediate annealing. Today in nearly all mills, except for very special purposes, copper is drawn hard from rod to finished wire. However, in some of the best mills intermediate annealing is still resorted to for a large part of the production. When fine wire is to be enameled, many mills depend on the heat of the enameling ovens for obtaining the necessary softness in the finished wire. When synthetic enamels requiring low heat are used, the wire is usually given a preliminary anneal before it is enameled.

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I should like to tell you about the Westinghouse Electric Corporation plant at Buffalo, which is an example of efficient copper wire mill: it was described in the August and September 1949 issues of WIRE AND WIRE PRODUCTS. Copper rods, each ⅜ inches in diameter, after being electrically butt-welded, are shaved to remove 0.008 inches from the surface at a speed of about 250 ft. per minute. When 16 coils each weighing 250 pounds have been welded and shaved, the full length weighing 4000 pounds is put on a 42 inch steel spool which is taken to one of the Vaughn heavy wire drawing machines. In this machine, there are five dies which draw the shaved rod down to 0.182 inch diameter in half-gauge steps. A 150 horsepower DC motor drives four blocks, 40 HP DC motor drives the fifth, and 22.5 HP DC motor drives the take-up reel. Speed is 800 to 1140 ft. per minute. Next are two

Syncro Machine Company, 13-die 100 HP DC Machines finish 0.129 inch (#8 AWG) to 0.051 inch (#16 AWG) in half-gauge steps. Finishing speed is about 3000 ft. per minute.

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Fine Wire Drawing

At the Westinghouse mill, wire which is to be made into finer sizes is given an intermediate anneal before it is drawn. Wire in sizes from 0.045 inch to 0.179 inch diameter is finished on one of the Syncro intermediate machines, having 12 dies, at a speed of 4000.

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For producing coarse fine wire, they use extra 14 and 16 die Syncro machines. The 14 die machines finish from 0.0254 to 0.0159 inches diameter at 4000 ft. per minute and the 16 die machines finish from 0.0159 to 0.0063 inches at 5000 ft. per minute.

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Likewise, Syncro machines are used for the finer sizes. The 16-die machines finish from .0056 to .0031 inches diameter at 5000 ft. per minute and the 14-die machines at 3500 ft. per minute from .0028 inches to .0020 inches diameter.

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At this point I should like to tell you that while nearly all manufacturers of wire drawing equipment helped me greatly in the preparation of this lecture, the Synchro Machine Company and Vaughn Machinery Company were outstanding in their contribution. They furnished me with many photographs together with the description of each machine illustrated. It is obvious that I can refer to only a few of them and I trust that those which are shown will give a good idea of the machines used in most of the mills producing copper wire.

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Fig. 19 shows Synchro's heavy wire three-block draw bench for either tandem or single hole operation. This machine takes a 3/8" diameter rod down to .258" in the first pass and in the second to .182" and finishes at .122" at the third pass.

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A battery of 16-die intermediate and fine wire Syncro machines is shown in Fig. 20.

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Fig. 21 shows a Vaughn 10-die tandem continuous machine for drawing rods to coarse sizes.

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A battery of three Vaughn No. 2A machines is shown in Fig. 22. These machines have a hydraulically operated spooler.

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Table VI lists the wire drawing machines used at the Westinghouse Electric Corp. plant in Buffalo, N. Y.

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Annealing

Today the copper available to the wire fabricator is of such high quality and the practice of hot-rolling and drawing so perfected that, except in special cases, it has been found unnecessary to do any intermediate annealing. In most modern mills, wire is today drawn from a 1/4 inch or 5/16inch diameter down to 0.001 inch diameter without intermediate annealing. However, as the wire after this heavy reduction is extremely hard, it must for most purposes be brought to the proper softness before it can be used. This final annealing has to be carried out in a neutral or slightly reducing atmosphere because copper oxidizes very readily at the temperatures required to obtain the desired softness. This annealing, called "bright annealing", can be done in two general types of furnaces; the stationary or bell type and the continuous type. The copper in coils or on spools is placed in a furnace and then completely covered by a stainless steel hood, of which the bottom edge dips into water to prevent air entering the hood during annealing. This type of furnace is usually heated by electricity but gas is also used. In some types of continuous furnaces, the spools are loaded one layer deep on trays holding about 200 pounds. These trays are pushed into the furnace filled with protective gas by means of a hydraulic pusher. The wire remains in the furnace for the period necessary to completely soften it and then pushed into a section cooled by water. This is very important for if the hot copper which has been protected from oxidation by the gas during annealing were to strike the air in that condition, it would be immediately discolored by a film of oxide. If cooled down to the proper temperature, the wire will not oxidize on exposure to the air and come out bright, dry and uniformly annealed.

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What I have said about continuous batch annealing, of course, also applies to the bell type. In these furnaces a water spray is allowed to play over the outside of the hood to accelerate cooling. Nearly any non-oxidizing atmosphere can be used for annealing copper, but it must be free of sulphur in any form, for this element is as detrimental to copper as oxygen.

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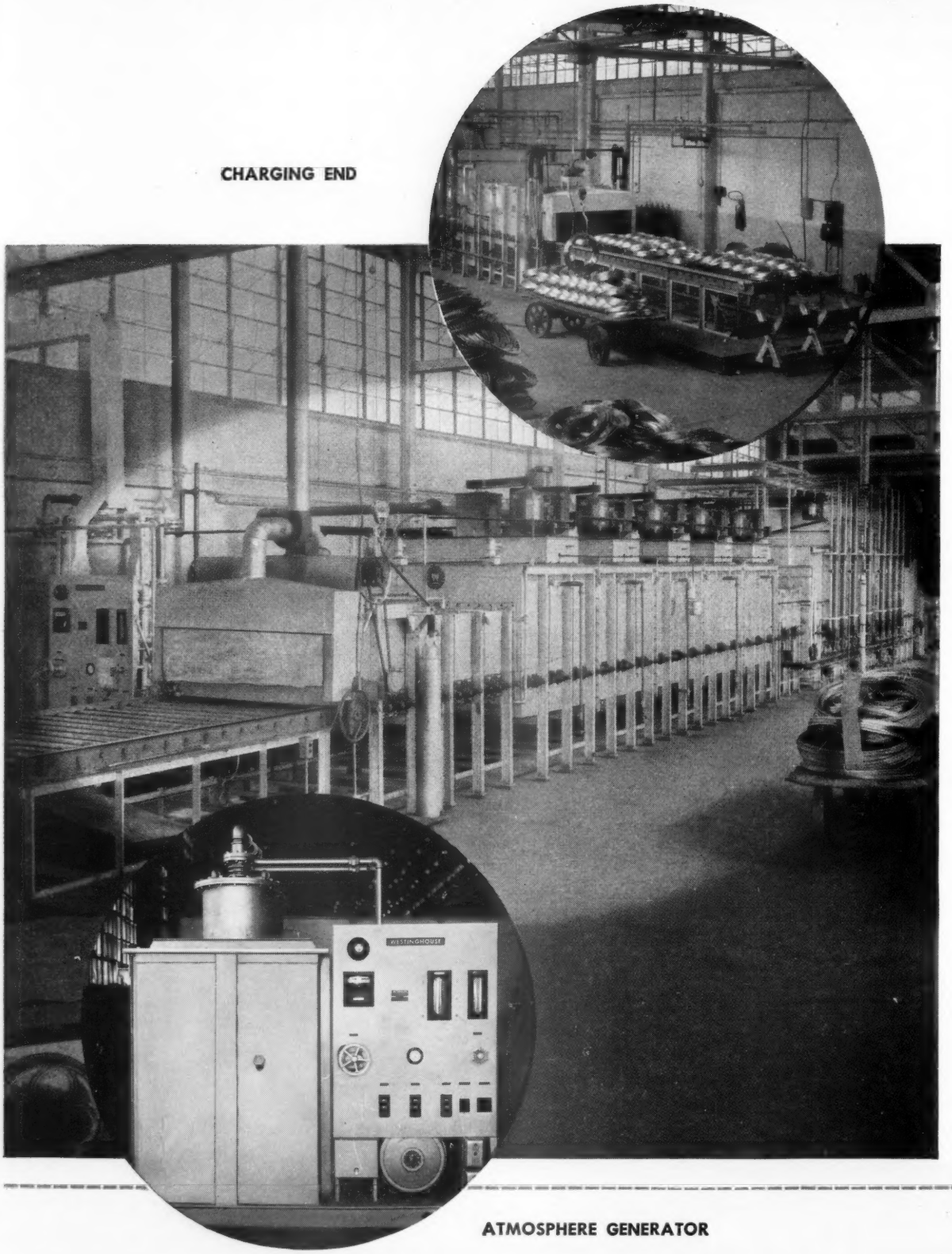
I must not neglect to mention

(Please turn to page 76)

MACHINES USED FOR SHAVING AND DRAWING COPPER WIRE AT WESTINGHOUSE ELECTRIC CORP., BUFFALO, N.Y.

MACHINE	MANUFACTURER	NO. MACHINES AVAILABLE	FINISHING SPEED RANGE F.P.M.	DIAMETER OF WIRE PRODUCED	UNIT PACKAGE WEIGHT
SHAVING					
3 BLOCK	WATERBURY-FARREL	1	300-450	0.520"-0.365"	1000 OR 4000
6 BLOCK	VAUGHN MACHINERY CO.	3	300-600	0.435 -0.193	4000
HEAVY DUTY BREAKDOWN					
5 DIE	VAUGHN MACHINERY CO.	1	800-1150	0.182 -0.136	500 OR 1000
13 DIE	SYNCRO MACHINE CO.	2	2000-3500	0.144 -0.051	500 OR 1000
INTERMEDIATE WIRE DRAWING					
12 DIE	SYNCRO MACHINE CO.	9	4000	0.045 -0.0179	250
COARSE FINE WIRE DRAWING					
16 DIE	SYNCRO MACHINE CO.	6	5000	0.0159-0.0063	40
14 DIE	" " "	2	4000	0.0254-0.0159	100
FINE WIRE DRAWING					
16 DIE	SYNCRO MACHINE CO.	2	5000	0.0056-0.0031	20
14 DIE	" " "	1	3500	0.0028-0.0020	8

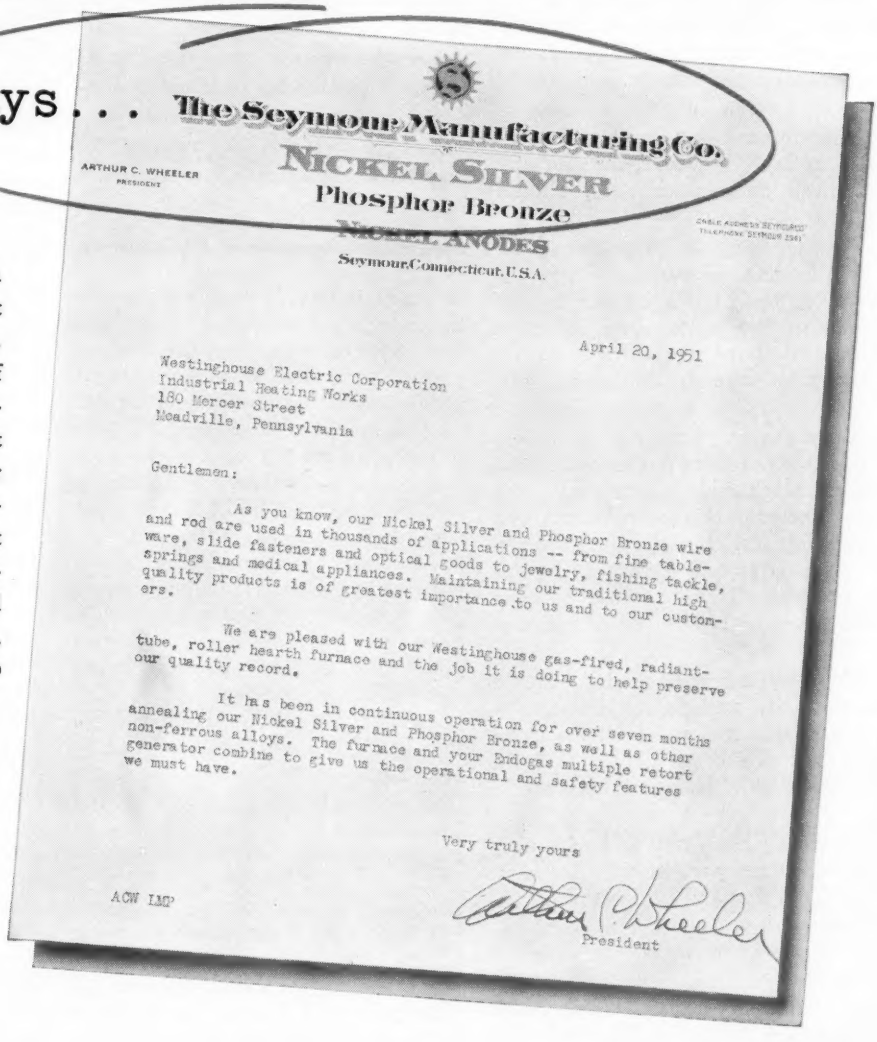


CHARGING END

ATMOSPHERE GENERATOR

"Gives us operational and safety features we must have"

says . . .



The Seymour Manufacturing Co.

ARTHUR C. WHEELER
PRESIDENT

NICKEL SILVER
Phosphor Bronze
NICKEL ANODES

Seymour, Connecticut, U.S.A.

April 20, 1951

Westinghouse Electric Corporation
Industrial Heating Works
180 Mercer Street
Meadville, Pennsylvania

Gentlemen:

As you know, our Nickel Silver and Phosphor Bronze wire and rod are used in thousands of applications -- from fine tableware, slide fasteners and optical goods to jewelry, fishing tackle, springs and medical appliances. Maintaining our traditional high quality products is of greatest importance to us and to our customers.

We are pleased with our Westinghouse gas-fired, radiant-tube, roller hearth furnace and the job it is doing to help preserve our quality record.

It has been in continuous operation for over seven months annealing our Nickel Silver and Phosphor Bronze, as well as other non-ferrous alloys. The furnace and your Endogas multiple retort generator combine to give us the operational and safety features we must have.

Very truly yours

ACW LMP

President

Gas-fired or electric, there's a Westinghouse Furnace to meet every heat-treating need. Select from a wide variety of standard units; or special designs can be prepared to meet particular needs. It's your assurance of an unbiased answer to your all-important problem. Westinghouse Electric Corporation, Industrial Heating Division, Meadville, Pennsylvania. J-10370

YOU CAN BE SURE... IF IT'S

Westinghouse

HEAT-TREATING FURNACES

IF YOUR PRODUCT CALLS FOR HEAT-TREATING . . . IT CALLS FOR A WESTINGHOUSE FURNACE . . . GAS OR ELECTRIC

How Will Business Be In 1952

In times of war, or threatened war, when the government is buying products containing every conceivable material used in production of goods for civilian consumption—to say nothing of its stockpiling program—anyone who forecasts the future is indeed sticking his neck out. Nevertheless, such forecasts are a definite help and we are grateful to the gentlemen who here depict conditions in their respective fields as they see them for 1952.

—by Avery C. Adams, President Pittsburgh Steel Company

Predicting future trends is a hazardous pursuit. This is particularly true today with world conditions subject to rapid change.

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The demand for steel rods and wire in 1952, however, barring any of these sudden changes, should continue strong.

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While demand for some types of wire has been curtailed due to cutbacks in the automobile industry, increased defense contracts should more than take up this slack.

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Government expenditures destined to strengthen our armed might should reach their height during the last quarter of this year. This means more planes, tanks, guns, ships, trucks, radar and electronic equipment, and all the necessary items needed to equip a modern army.

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Tools must first be made to create these many and varied items. Existing structures must be enlarged and in many cases new ones built before production can take place.

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Certainly steel rods and wire play an important part in this program. Increased demand under these conditions is a certainty.

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Most of the major steel producers have taken steps, or are taking them, to increase the steel making capacity of their plants. Many of these projects will reach completion during this year. This should aid immeasurably to place the industry in a much stronger position to meet this increased demand.

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—by John A. Coe., Jr., President The American Brass Company

Any organization that is at all concerned with the use of copper products in its business has very good reason for wanting to know what the real facts are in the copper industry today. To you who are in this category it must seem that there is a general conspiracy to confuse you. You read of a vast armament program—both at home and on the part of our friends abroad. To help provide copper for such a program the National Production Authority first issued Order M-12 limiting the use of copper—and then followed by issuing an amendment which completely prohibited the use of copper for certain civilian products. Then you hear all kinds of stories about the copper shortage being more serious now than it has ever been and there are daily rumors that it will get worse instead of better. Some of these reports might lead you to believe that the United States is actually running out of copper.

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I hope that I can clear up some of the questions that surround this whole copper picture. The principal thought that I would like to leave with you is that the United States is today producing a lot of copper—about half again as much as we produced in an average prewar year—1935 to 1939. 1951 production is running at the rate of 963,000 tons, compared with 643,000 tons during the prewar period and exceeding the average of the last four years by more than 100,000 tons. The pinch is caused not by decreased production but by increased demand, principally for the war effort.

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A great deal is being done to remedy this situation in the not too far distant future. My own company is affiliated with Anaconda Copper Mining Company, which initiated several years ago at its own expense, approximately $27,000,000, the Greater Butte Project which will make available large quantities of copper supplementary to its present production in Butte. Additional output in 1952 will be approximately 20,000 tons, increasing gradually to 45,000 tons of copper per year.

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The Phelps Dodge people are now developing their Bisbee East ore body in Arizona which will bring in 38,000 tons per year. Miami Copper Company is going ahead with its 22,500-ton Copper Cities project. Much is heard of Magma Copper Company's San Manuel project which has a large ore body. The White Pine property owned by Copper Range will doubtless be brought into operation. Other developments are expected. As these projects become realities we may anticipate domestic production to be increased by more than 200,000 tons of copper per year in a comparatively few years.

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Copper production is also being expanded abroad. The great Sulphide Plant of Chile Exploration Company, another subsidiary of Anaconda, is expected to be in operation in its initial stages in 1952 and to be completed before the end of that year. Expenditures on this project will exceed $90,000,000. Rhodesian copper production is being steadily increased. Many other projects for increased production are being developed in friendly countries abroad, both by private capital and with ECA assistance.

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Primarily our difficulty today is the vastly increased demand for copper. Copper has gone to war. We must recognize that fact and admit the propriety as well as the

(Please turn to page 62)

WIRE ASSOCIATION PROCEEDINGS

Discussions of Papers Presented at the Wire Association Annual Convention at Chicago, Illinois, October 22-25, 1951

MEETING
MONDAY, OCTOBER 22nd

Chairman of Meeting
Ralph B. Roth, Vice Pres.
Ludlow Saylor Wire Co., St. Louis, Mo.

Address of Welcome by Fred M. Crapo, President, The Wire Association

PAPER: "Communications Wire Program of the Signal Corps."	Methods and manner of procurement of wire and cable. Present and probable future needs of these items.	by Major Howard F. Cleary Signal Corps, U. S. Army Philadelphia, Pa.
PAPER: "Composite Insulation of Polyethylene and Nylon as Protective Jackets."	Coatings used on assault wires with special reference to WDI. Methods of processing will be discussed.	by James E. Flood, Chem. Eng. Plastic Wire and Cable Corp. Jewett City, Conn.
PAPER: "High-Strength Copper-Silver, Copper-Iron and Copper - Iron - Chromium Wire."	New copper-base alloys have been made into wire for the Signal Corps, embodying unusual properties. Iron as a reinforcing fibre is a new concept in wire making.	by Walter Hodge Ralph A. Hoppe Bruce W. Gonser Battelle Memorial Institute Columbus, Ohio.

This Technical Session convened at 2:00 o'clock, Mr. **Ralph B. Roth** presiding.

Chairman Roth: Mr. President, Officers, Directors, Members of The Wire Association and Guests: In April, 1950, when I was invited to act as your Program Chairman of this convention, I felt very honored. However, I hesitated to accept, knowing the tremendous work involved. But with the assistance of such capable gentlemen as Mr. John Moritz, Superintendent of the Keystone Steel and Wire Company of Peoria; Dr. Bruce W. Gonser, of the Battelle Memorial Institute; Mr. Richard E. Brown; and Mr. Edmund Sickels of The Wire Association, I have found it most interesting and educational. At this time I want to express my sincere thanks and appreciation to these four gentlemen.

It gives me great pleasure to introduce these four gentlemen to you. **Mr. John Moritz,** will you stand, please? (Absent) **Dr. Bruce Gonser.** (Applause) **Major Richard E. Brown** and **Mr. Edmund Sickels.** (Applause)

I hope you will find our program this year most instructive and as fully covered as our time will permit. Allow me to call to your attention that, beginning at nine-thirty tomorrow morning, the meetings of the ferrous program and the non-ferrous program will be held in separate halls.

Before beginning today's program I should like to have our President, **Mr. Crapo,** address you briefly. (Applause)

President Crapo: Members and Guests: It is a great pleasure to extend to you the cordial greetings and welcome of the officers and directors of The Wire Associaiton at this opening of our Twenty-second Annual Convention.

You will be interested to know that our registration is the largest in our history and includes some sixty allied friends from six countries: Canada, England, Wales, Belgium, Western Germany and India.

When we met a year ago, there was just being instituted a plan for international defense. Today, this program for mobilization and readiness has advanced far beyond our expectations and the wire industry faces a challenge and many new problems in its position of vital importance to defense and war planning. Under these circumstances, this convention offers unusual opportunities for the further strengthening and advancement of the wire industry which inevitably has resulted from friendly discussions of production problems, technical matters, new developments, and making interesting plant inspections.

The Progam Committee under Ralph Roth's able leadership as General Chairman, has arranged a most interesting and balanced program. A plant inspection trip, as you know, has been arranged for Thursday by the American Steel and Wire Company to their wire mills at Joliet, and this is greatly appreciated by us all.

It is especially gratifying to note the marked growth of our Non-Ferrous Division and the obvious success of holding simultaneously, a session for each, the Ferrous and the Non-Ferrous Divisions.

It is hoped that our technical sessions will develop questions and lively discussions, and it is intended that each one shall express his thoughts frankly and make any possible interesting contribution. Thus, we should attain the maximum success in our meetings.

If you will bear with me a minute I would like to read a telegram which I have been asked to read. It is from R. W. Wolcott, Chairman of the Steel Industries' Scrap Mobilization Committee:

(Mr. Crapo then read Mr. Wolcott's telegram describing the critical need for steel scrap and requesting the cooperation of our membership in setting up and following through on a continuing scrap salvage program.)

I am sure we all appreciate the critical situation with respect to getting all possible scrap, and I am also sure that the length of this telegram will emphasize for each of us how impressed Mr. Wolcott is with the job he is trying to do.

(Please turn to page 88)

MEETING TUESDAY, OCTOBER 23rd
FERROUS SECTION

Morning Session—9:30 A. M. Chairman of Meeting: Fred H. Parkin, The Parkin Chemical Co., Pittsburgh, Pa.

PAPER: "A Progress Report on the Development of the Wheelabrator Mechanical Cleaning Process."	Sulphuric acid shortage makes consideration of dry-cleaning desirable. Covers cold rolling and drawing.	by Gilbert H. Dill, Sales Eng., Charge, Steel Division American Wheelabrator and Equipment Corporation Mishawaka, Ind.
PAPER: "Depolarizing Agents and Their Effects and Savings in Cleaning of Rods and Wire."	Addition of depolarizing agent to acid will save acid, speed pickling and increase adherence of secondary coatings.	by Joseph T. Irwin, Chemist, Azed, Inc., Div. of Promat Div. of Poor and Company Waukegan, Illinois

CHAIRMAN PARKIN: This morning there will be two papers. The first one is from the American Wheelabrator and Equipment Corporation, "A Progress Report on the Development of the Wheelabrator Mechanical Cleaning Process." After delivery of the paper the speaker will give out samples of the new Tru-Steel abrasive along with samples of cleaned rods and cold drawn bars. Your next speaker is Mr. Gilbert H. Dill. Mr. Dill. (Applause)

(Mr. Dill read his paper.)

Gentlemen, you are invited and urged to make Mr. Dill a target for the nonce and fire questions at him.

My very first question when he sat down here was, if this machine is so good, will it eliminate pickling? We would all like to get rid of pickling, but there would be a lot of people selling acid and, more specifically, pickling compounds, who would be absent without leave from these meetings, myself included.

Are there any questions now that you would like to fire at this gentleman to start a discussion?

A Member: I did not hear any mention of the die life. Have you had any experience with that to determine the die life as compared with acid cleaning?

Mr. Dill: Yes, a little. The dies at Columbia Steel are tooled steel dies which have a Rockwell hardness of about 35 on the C scale, and after we found the proper abrasive to use they had no trouble with their dies. I mean that the die life is the same as it has always been.

A Member: We are very much interested and we are certainly going to look into it.

Mr. Dill: I might add in that connection that this machine at Columbia Steel is cleaning bar stock from 1 inch in diameter to 6 inches in diameter, mill lengths, and when we first started out we ran up to 2 and 2½ inches and we had no trouble whatsoever with this Tru-Steel shot. But when we started to run the larger stuff and the heavier bars through, there we found that the weight of the bar would cause the little pieces of shot that got between the bars and the conveyor roll to be pressed into the steel to the point where they would carry through and get into the die and scratch it. To correct that situation the machine now uses nail whiskers as abrasive, which are soft, do not embed and still do a good cleaning job.

A Member: Is this a dry process or can the material entering the machine be wet?

Mr. Dill: It is a dry process. On all of our equipment cleaning strip, sheets and bar stock, if the material is subject to becoming wet it is necessary to put a Dutch oven, a gas flame or other drying equipment in to absorb any excess moisture. When I say "wet" I mean excess moisture on the surface. The reason for that is that the moisture contaminates the abrasive, and if it is of any great magnitude the abrasive will ball up. I have seen sheets in the winter time go through a machine, and bar stock, too, wet to the touch. That does not affect things because actually the energy in the shot blast is so great that when you put cold material into the machine it comes out warm.

A Member: On this machine at Columbia with a 1-inch round bar, how fast can you run it through the machine?

Mr. Dill: A 1-inch round bar they are running at about 60 feet a minute.

A Member: The next question is have you ever tried it on rectangular shapes?

Mr. Dill: Yes, on this same machine we have cleaned the smaller sizes of squares and hexagon bars. We have a skew roll-type conveyor and it will clean squares and hexes up to the point where the action of the skew roll on the square will turn it. When the size of the square gets too big for that action to be effective, it won't turn and consequently we don't get it over all. We use another design for that.

A Member: You spoke of several types of abrasive which you use. What type of steel do you use in this shot and how big is the shot?

Mr. Dill: I said several types. We have standardized on Tru-Steel shot, but in this particular case of Columbia Steel—and, incidentally, all other applications of the same nature—where the weight of the particle being cleaned might shove the hard abrasive into the surface we use nail whiskers. That is a very low, soft carbon steel. The Tru-Steel shot is a product made from scrap in a duplexing process. It is melted in a cupola and then refined in an electric induction furnace. The final product is a 90 carbon steel. The shot is cast in a special patented process and then graded and heat treated to draw it back to the proper hardness, 45 Rockwell C. After that it is banged in shape.

A Member: One part you did not answer. What diameter?

Mr. Dill: Oh, I beg your pardon. The size of the shot is controlled by the SAE standards. The smallest size is 1-10 designation, which is .011 inches in diameter. From there it goes up to S 690 which is .69 inches in diameter. The samples that we have to give away are S 1-10 material, which we believe is the best suited for cleaning small diameter rods.

Chairman Parkin: A question has just been handed to me: "Does this process produce a surface to which plating will adhere well?

Mr. Dill: Chrome plating, no, it is not smooth enough. Zinc plating, yes. We have just finished tests for the Steel Corporation in California where sheets have been blast cleaned without any pickling whatsoever and galvanized in the regular manner and produced prime material. The surface that we are producing on these drum sheets has a brush analyzer roughness just a few points higher than a pickled surface.

A Member: Is that electroplating or hot galvanizing you are referring to?

Mr. Dill: It was hot dipped galvanized.

A Member: What about electroplating?

Mr. Dill: We are installing a machine at the Rome Cable Company in California right now to clean strip for splitting into the proper widths for electric weld conduit which is to be electrolytically galvanized.

A Member: I do not believe Mr. Dill made any comments on the cut wire shot that I believe is being used to a considerable extent in abrasive cleaning and for improvement of fatigue in springs, etc. Would you care to comment on that?

Mr. Dill: I most certainly would. It is an excellent product. As a matter of fact, it is better than our Tru-Steel. I do not like to say that, but you cannot get around it. It is more uniform in quality. It is a cold-worked product to start with, or it is the same as comparing a steel casting with a steel forging. However, in the scaling of steel products for the steel industry we have found that to get a surface which is acceptable for all the various uses to which they want to put the steel, we of necessity had to go to the smaller sizes or the smaller range of sizes of abrasives. For instance, it is a matter of cost. A cut wire in the neighborhood of .028 inches in diameter costs around $575 a ton. Our Tru-Steel shot in all sizes from the large to the small sells for $275 a ton. When you get down into the range of S 1-10 Tru-Steel shot, the equivalent in cut wire, which, incidentally, is not yet on the market, would cost, I have been told, somewhere above $600 a ton.

A Member: In that three triangular set-up you had here for cleaning wire, was that 4-inch rod?

Mr. Dill: A No. 5 rod, but we have the same design for a 1-inch rod.

A Member: You claim you are running that at 80 feet a minute?

Mr. Dill: That is right, sir.

A Member: If you are running chrome nickel in there how much will you raise

(*Please turn to page* 94)

MEETING
TUESDAY, OCTOBER 23rd
NON-FERROUS SECTION

Morning Session—9:30 A. M. Chairman of Meeting: J. H. Gillett, V. P., Industrial Ovens, Inc., Cleveland, O.

PAPER: "Process Control for Enameling Copper Magnet Wire."	Illustrates and describes the controls essential to operate a wire enameling plant. Automatic viscosity and temperature controls discussed.	by R. F. Thompson, Supervisor, Engineering & Development, Copper Wire Department, Westinghouse Electric Corp. Buffalo, New York
PAPER: "Catalytic Combustion of Wire Enameling Fumes."	Shows how fuel costs, shut-downs, air pollution and fire hazards can be reduced in wire enameling operations.	by R. J. Ruff, President Catalytic Combustion Corp. Detroit, Michigan
PAPER: "Fiberglas Textiles in the Wire and Cable Industry."	Fiberglas textile applications to electric wire—performance properties, economics and new developments.	by W. Kenneth Lydic, Research Eng. Ashton Laboratory Owens-Corning Fiberglas Corp. Ashton, Rhode Island

Mr. Gillett: Good morning, Gentlemen! Let us proceed to the first paper, which is entitled "Process Control for Enameling Copper Magnet Wire". It is to be presented by Mr. R. F. Thompson, Supervisor, Engineering and Development, Copper Wire Department, Westinghouse Electric Corporation, Buffalo, New York.

(Mr. Thompson read his paper.)

Mr. Gillett: Are there any questions on the slides or shall we turn them off now?

A Member: Is the enamel handled through the system shown on this slide fed to a bank of machines or do you have a separate viscosity control system for each enamel tower?

Mr. Thompson: In our plant we have six systems set up. We have six reservoirs and six exchangers and, in this manner, we can adjust the viscosity for different ranges of wire sizes and we can also adjust separately synthetic enamels as well as the conventional types.

Any other questions?

(No response.)

(Mr. Thompson then concluded his paper.)

Mr. Gillett: Thank you, Mr. Thompson, for a very interesting paper.

The next speaker has a paper which, I am sure, will be of great interest to all of us. It has to do with the catalytic combustion of wire enameling fumes, and will be presented by Mr. R. J. Ruff, President, Catalytic Combustion Corporation, Detroit, Michigan.

Mr. Ruff: Mr. Gillett and Gentlemen:

(Mr. Ruff read his paper.)

Mr. Gillett: Are there any questions for Mr. Ruff?

A Member: Mr. Ruff, we do not have the enamel fume problem, but in several of our operations we have a phenol formaldehyde problem and I am wondering if you have had any experience in that field?

Mr. Ruff: Is that in connection with binders for glass?

A Member: Yes.

Mr. Ruff: Our initial installations for this type of service is now being placed in production and involves four units having a capacity of about 3,000 C.F.M. each. On glass, we do run into one problem not normally present in the wire enameling field and that is the matter of clogging of the catalyst by glass lints. It is recognized that there will be a periodic cleaning problem involved. We don't know how frequent this will be, but on units now in operation handling the exhaust from ovens making enamel on glass covered conductors, there is sufficient lint in the atmosphere to introduce a cleaning problem once every several weeks on the entry space of the catalyst.

A Member: Is there a possibility of using a glass mat in your catalyst construction?

Mr. Ruff: Yes. As a matter of fact, we have made tests on it and the only defect that we see at the present time lies in the possibility of the glass being subjected to excessive temperatures. It probably would be satisfactory if we could be assured of having temperatures in the catalyst below approximately 900 degrees Fahrenheit but we have run into some jobs involving temperatures of 1400 or 1500 degrees Fahrenheit. We recommend a good workable maximum of 1200 degrees Fahrenheit on the discharge side of the catalyst, although the element itself can be subjected to 1800 or 2000 degrees momentarily without doing any harm. At temperatures over 2000 degrees Fahrenheit, we encountered danger of melting the catalyst and we have had some failures for precisely that reason. In those cases, the fume concentration was brought higher and higher by reducing the oven ventilation to the point where the lower flamable limit was being approached and then the heat release was so intense on the catalyst that it actually carried it right up to the melting point. We try to build the equipment to come as close as possible to meeting unusual conditions that may exist.

Mr. Gillett: Thank you very much, Mr. Ruff.

In his talk, Mr. Ruff touched on work done by Mr. Goss of the Connecticut Department of Public Health. This work had special reference to the safety and hygiene involved with oven fumes and the catalytic combustion of these fumes. The Wire Association has asked Mr. C. A. Litzler, President of Industrial Ovens, Incorporated, to discuss the work of Mr. Goss.

Mr. Litzler: Thank you, Ken.

(Mr. Litzler then delivered a summary of Mr. Goss' paper that was scheduled for publication in the November issue of Wire and Wire Products.)

Mr. Gillett: Departing now from the subject of wire enameling, our next paper is entitled "Fiberglas Textiles in the Wire and Cable Industry". It will be presented by Mr. W. Kenneth Lydic, Research Engineer, Ashton, Rhode Island Laboratory, Owens-Corning Fiberglas Corporation.

Mr. Lydic: Mr. Gillett, members of the Wire Association:

(Mr. Lydic delivered his paper.)

Mr. Gillett: Any questions?

A Member: Are you making any progress on a treatment for fiberglas that will make it similar to the wax treatment on other types of yarns for cable?

Mr. Lydic: Yes. The new dyed yarns are treated so that they have good adhesion to lacquers. In addition, the new yarns will have greater uniformity of color from batch to batch.

A Member: What about package size?

Mr. Lydic: The packages we furnish are as recommended by the braider manufacturers. On a package of certain weight, you will find a greater length of glass yarn than of other materials. This obviously decreases the shutdown time for changing packages on the braiders.

Mr. Gillett: Since there are no further questions, our session stands adjourned.

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MEETING TUESDAY, OCTOBER 23rd

FERROUS SECTION

Afternoon Session—2:00 P. M.

Chairman of Meeting: Tom M. Girdler, Jr., Supt., Union Drawn Steel Division, Republic Steel Corporation, Beaver Falls, Pennsylvania

PAPER: "Maintenance and Improvement of Quality Cold Heading Wire."	Factors affecting cold heading properties and methods adopted at Keystone to improve the quality of such wire.	by Lester R. Franks Wire Mill Met. and John Harrigan, Chf. Metallographer Keystone Steel and Wire Co. Peoria, Illinois
PAPER: "Problems and Progress in the Manufacturing of Bolts, Nuts, Etc."	From the maker's point of view—the problems of fabricating fasteners.	by William E. Hill, Jr., Plant Supt. Russell, Burdsall and Ward Bolt and Nut Co., Rock Falls, Illinois

Chairman Girdler: This morning all of us learned how to clean our product before drawing or fabricating, and I think we settled all the cleaning problems this morning. This afternoon we get into the actual operation of the wire mills.

The first paper is a paper written by Mr. Lester R. Franks, Wire Mill Metallurgist, and Mr. John Harrigan, Chief Metallographer of the Keystone Steel and Wire Company of Peoria, Illinois. The paper will be given by Mr. Franks on "Maintenance and Improvement of Quality Cold Heading Wire." After the paper is presented any questions you may have I know the gentlemen will be glad to answer.

(Mr. Franks presented his paper.)

Chairman Girdler: I imagine we have some questions we would like to ask the authors of this paper. I am sure Mr. Franks will be glad to answer any questions.

A Member: With regard to the pierced tubular ribbon, from your experience have you come to any conclusion as to the finish which would produce the best die life?

Mr. Franks: In answer to that question I would say we have not done much work with regard to finisher types of coating. We have adopted a coating which has produced exceptionally good die life. Does that answer your question?

A Member: You were talking about grease finisher in your talk, grease finish drawn wire.

Mr. Franks: That is a lubrication we use. We just draw the wire through a cut grease, and, as I said, so far that gives exceptionally good die life and heading performance.

Chairman Girdler: Any other questions?

A Member: With the increase in cold heading, which is very severe, what part does decarburization play in cracking?

Mr. Franks: In my estimation it plays a very important role there because you have a zone or a rim of relatively pure iron and the heading properties should be much better. From the standpoint of heat treating, though, with carburization you do not obtain surface hardness and the hardening results will be much lower.

A Member: That answers my question on that. Wouldn't it be a forward movement to carbon-correct your surface, that is, bring the carbon back, restore the carbon in the rod or bar to avoid any decarburization?

Mr. Franks: As I understand your question, I believe the proper place for carbon restoration is after you have done your heading operation; during your heat treating operation, if the material is not to be hardened I do not think there is much concern there. Only from the standpoint of obtaining hardness would there have to be some carbon restoration there.

A Member: The carbon restoration could be done in the rod?

Mr. Franks: Yes, it could, but that would necessitate a lot of extra equipment and handling.

A Member: Well, I think that is something on cold heading that the wire industry should be thinking about. I know there has been a lot of thought given to it, carbon restoration in the rod, particularly in aircraft bolts and alloy steels.

Mr. Franks: Of course, I think it can be done, but I think the most economical way is to do it after the blank has been made.

A Member: It probably is unfamiliar to you but we are doing carbon restoration, not on coils particularly, but on bars. It has been done on coils. We will bring the surface back to its original carbon content, so that there will be no surface decarb. That operation is peculiar to Republic. I thought it would be of interest to those who run furnaces and cold headers. We are not equipped now to do coils. We do it on bars, particularly for the agricultural field where there is a large tonnage used. Formerly the surface was turned. Now they are using the drawn surface to secure their hardness.

Mr. Franks: It can very easily be done in the annealing furnace. For instance, the retort could be charged, and in our case, where we are using neutralizing gas, we could change the neutralizing gas over to carburizing gas and accomplish some of that operation, but as to how uniform it would be, I do not know. So that is one reason I say the best and most economical way would be after the part has been heat treated.

Chairman Girdler: Any other questions, gentlemen? If not, thank you very much, Mr. Franks, for a very interesting paper.

We will go on now to the next paper on the program. Our next paper is being presented by Mr. William E. Hill, Jr., Plant Superintendent of Russell, Burdsall and Ward Bolt and Nut Company, Rock Falls, Illinois. The title of this paper is "Problems and Progress in the Manufacturing of Bolts, Nuts, Etc."

Mr. Hill presented his paper.

Chairman Girdler: Thank you, Mr. Hill.

Do we have any questions that you want to put to Mr. Hill? I am sure he will answer all of them. Anybody have any question?

A Member: Mr. Hill, with regard to spheroidizing, you said it was possible to eliminate all of that necessary processing, heating to 1300° and holding and drawing back, etc. What can you offer as a simple way of spheroidizing steel?

Mr. Hill: I would not say that it would end up spheroidized. It depends on what your end application is. A lot of times you might want to make a cap screw, which I would not say would be a tough upsetting job for the C-1038 specification. A lot of times you can just take the skin-draft of your green rod and come out with a very good cap screw and in that way just eliminate it completely. Other times, if your application is a little more severe, you run your spheroidizing through, as we say, on stilts and get just a slight breakdown.

Chairman Girdler: Any other questions?

A Member: I should like to ask Mr. Hill if you are worrying in this country about the nitrogen content in steel. As you know, in Belgium and in most continental countries we use Bessemer basic steel, which has naturally a high nitrogen content, and we are making experiments to lower the nitrogen content because we are aware of the fact that low nitrogen content helps cold heading.

Mr. Hill: I am very sorry, sir, I know very little about that. Possibly there is someone out on the floor—

A Member: Maybe you don't have to worry about that because the nitrogen content is already low in open hearth steel.

Mr. Hill: Again I say I know very little about it. Possibly a Keystone man here, a Sheffield man, or a Republic man could get up and help you out on this question.

Chairman Girdler: Any other questions?

If there are no more questions, I know we are grateful for these two talks we have had this afternoon, and I think we can say that they have contributed greatly to the success of the annual meeting.

Chairman Girdler: If there is nothing else, we will call the meeting adjourned.

MEETING
TUESDAY, OCTOBER 23rd
NON-FERROUS SECTION

Afternoon Session—2:00 P. M. Chairman of Meeting: Joseph E. Wiltrakis, Asst. Supt., Mfg. Eng., Western Electric Co., Kearney, N. J.

PAPER: "Rigid Polyvinyl Chloride Insulations."	These new insulations provide advantages not achieved by plasticized compounds. Their characteristics are set forth in the paper.	by Willard de C. Crater, Asst. Mgr., Vinyl Sales Naugatuck Chemical Div., U. S. Rubber Company Naugatuck, Conn.
PAPER: "Improvements in Cable Lacquers Through the Years."	Qualities and characteristics of lacquers used for wire coatings.	by Joseph S. Hawes, Manager Cable & Coating Division New England Lacquer Company East Providence, R. I.
PAPER: "The Preparation of Dry Blend PVC Compounds for Extrusion."	Describes new blending process that eliminates previous difficulties of clogged screens and porosity. Slides illustrate principles of operation.	by Sidney R. Dresser, Manager, Wire Mill Division Mercer-Robinson Company New York, N. Y.

Mr. Wiltrakis: The first paper, "Rigid Polyvinyl Chloride Insulations," will be given by the first speaker who has had wide experience in plastics research and manufacturing with the Hercules Power Co., Federal Telephone and Radio and the Glenn H. Martin Co. He holds a number of patents on plastics and is an active member of the American Chemical Society. He is at present Assistant Manager of Vinyl Sales of the Naugatuck Chemical Division of the U. S. Rubber Company. Gentlemen, it is with pleasure that I present Willard deCamp Crater.

(At this point, Mr. Crater gave his talk on Rigid Polyvinyl Chloride insulations and described the plastic materials displayed on the speaker's table).

Mr. Wiltrakis: Thank you, Mr. Crater. The meeting is now open for discussion of the paper on rigid polyvinyl chloride insulations. For a moment, I was about to conclude that Mr. Crater answered all of your questions, gentlemen, in his talk and description of the material displayed. However, I see there are questions to be answered.

A Member: Why is the abrasion resistance of Marvinol rigids considered better than some of the other insulating materials?

Mr. Crater: The abrasion resistance of small wires such as #20 or #22 AWG copper insulated with about a ten-mil wall of rigid vinyl, compared to similar size wires insulated with conventional flexible vinyl compounds, show that the rigids are definitely superior. If you simply abrade the insulated wire over the corner of this table, you will find that the bare conductor will be exposed after about 12 to 15 movements with the wire insulated with a soft vinyl compound. On the other hand, after twenty cycles with a rigid insulation, the conductor will fracture before cut-through of the insulation.

A Member: What are the gravities for the various Marvinol rigid compounds, and their price?

Mr. Crater: Gravities range from less than 1.4 to approximately 1.55. Price in 20,000 pound quantities is approximately 70¢ a pound.

A Member: Have transparent or translucent rigids been prepared with your materials?

Mr. Crater: Yes, compounds of this type have been produced. Naugatuck Chemical, however, has concentrated their work on opaque compounds because of better stabilizing possibilities. As you know, this is of extreme importance, especially in crosshead extrusion for the insulation of wire.

A Member: Do you believe that Marvinol rigids could be used to replace wires now insulated with polyethylene, and jacketed with nylon?

Mr. Crater: Yes, in some cases this would be possible. However, it would depend on the individual requirements, such as electrical characteristics, which of course are not as good as polyethylene. The size of wire in regard to stiffness, low-temperature flexibility required—all would have to be considered. Small telephone wires, which are massed together in banks, might be cited as an example. Wires covered with flexible polyvinyl chloride compounds, or rubber, tend to mat together, and it is difficult to pull out one wire without grabbing and fracturing of the conductors. Nylon has been extruded over both rubber and vinyls to eliminate this difficulty. The use of the rigid vinyls for applications of this type offers high slippage during pull, and lack of cut-through.

A Member: Is the high molecular weight of your Marvinol VR-10 the major reason for your success in fabricating rigid vinyls?

Mr. Crater: Naturally, molecular weight is one of the contributing factors in maintaining high physical characteristics. Nevertheless, inherent heat stability of the polymer itself is the major reason. Proper formulation and exacting extrusion conditions must be utilized also, to produce the best product.

A Member: How does extrusion affect properties of the insulated wire?

Mr. Crater: Any plastic material must be fabricated within rather exacting limits, if the maximum characteristics of the material are to be achieved. Rigid vinyls, if extruded at too low a stock temperature, will frequently appear satisfactory to the eye, but will fracture on simple flexing. Low temperature flexibility, for example, may be impaired by employing too high or too low a stock temperature during insulation of the wire.

Mr. Wiltrakis: Are there any more questions? Thank you, Mr. Crater.

A change has been made in the previously announced program. The talk to be given is "Improvements in Cable Lacquers Through the Years." Your next speaker has developed and perfected many coatings for braided wire as a chemist and development engineer. He has been associated with New England Lacquer Company since 1918. Your speaker is Joseph S. Hawes.

(Mr. Hawes delivered his paper.)

Mr. Wiltrakis: The meeting is now open for discussion. Do you have any questions for Mr. Hawes?

A Member: Does your cable coating pass MIL-W-5086 Specifications?

Mr. Hawes: To our knowledge, at the present time there has been no officially approved sources of supply to meet this specification. If you will tell me the part of the specification you are referring to, I shall try to give you a more direct answer.

A Member: I have reference to the fungus resistance requirements.

Mr. Hawes: It is the feeling of many of us that a wire construction will not meet this requirement as it is presently described. I believe a change in procedure is in the works at the present time.

A Member: How about abrasion resistance requirements?

Mr. Hawes: We have tested many types of coatings on the specified abrader and this qualification is no longer the problem that it was originally.

A Member: How do your coatings adhere to glass braided wire constructions?

Mr. Hawes: In addition to the improved color of the glass yarn that was discussed by Mr. Lydic earlier today, the surface lubricant has been designed to be more readily compatible with the generic classes of coatings and based on tests that have been conducted to date, we feel that you will note a marked improvement in the adhesion between coatings and glass braid using this newer dyeing method. As you may know, many of the adhesion problems in the past have been due to the incorporation of an incompatible type of surface lubricant.

Mr. Wiltrakis: Thank you, Mr. Hawes. The third and last paper this afternoon will be on "The Preparation of Dry Blend P.V.C. Compounds for Extrusion." Your third speaker was not content with an M.E. and E.E. degree, but during his experience with the Signal Corps, became interested in Plastics Engineering. He is now Manager of the Wire Mill Division of the Robinson Manufacturing Company. May I present to you Mr. Sidney Dresser.

(Please turn to page 93)

MEETING WEDNESDAY, OCTOBER 24th

FERROUS SECTION

Morning Session—9:30 A. M.

Program Chairman: L. C. Crewe, Jr., Pres., Maryland Fine and Specialty Wire Co., Cockeysville, Md.

PAPER: "Wet Chemical Blanket or Hot Galvanizing Surfaces."	Paper sets forth possible savings in zinc spelter in continuous hot dip galvanizing by use of a wet chemical blanket.	by A. A. Paterson, Sales Eng. Dewey & Almy Chemical Co. Chicago, Illinois
PAPER: "New Paper Container for Nails."	A description of a new type of paper carton that takes less space and withstands rough usage.	by Richard E. Oas, Mgr. Sales Promotion, Container Div., International Paper Co., Chicago, Ill.
PAPER: "Patenting with Continuous Cleaning and Coating."	This paper traces rods through various stages of preparation for drawing, discussing practices that make for good wire.	by C. H. Williams, Jr., Wire Mill Supt. Pittsburgh Steel Company Monessen, Pennsylvania

Chairman Crewe: We have a very full program this morning and want everybody to get what he came here for. There are three papers, one of which does not appear on the printed program. That is a dividend. I will tell you about it a little later. In the meantime, something about a liquid blanket. We have a paper on liquid chemical blankets for hot galvanizing and believe me when we say "hot", you are going to see something hot — hot galvanizing surfaces. A gentleman from Dewey and Almy Chemical Company right here in Chicago has consented to give you a paper on this interesting and timely subject. It is a new development in hot galvanizing. We are very happy to have Mr. A. A. Paterson with us this morning. Mr. Paterson.

(Mr Paterson presented his paper)

Chairman Crewe: Thank you, Pat.

Summing the situation up, gentlemen, we have reduced skimmings, reduced draws, increased safety, lessened zinc oxide fumes, lessened fluxing costs and established savings of zinc. I am sure that friend Pat will be glad to entertain any hecklers who might come forward. Who is here who would like to question a bit the conditions of this blanket?

A Member: With respect to the blanket itself, will it allow aluminum to be used in the bath? In other words, a lot of blankets are used with the aluminum depleted and you cannot use it for certain types of work. Will it remove the aluminum or can you keep the aluminum in the pot?

Mr. Paterson: Frankly, I cannot give you a definite answer on that. I believe in some plants there has been aluminum used. I am not certain however. I cannot think of any reason why it should affect the blanket.

A Member: The ordinary zinc ammonium type blanket depletes the aluminum very fast and you cannot use the blanket for that reason. You mentioned about the ammonium chloride fumes. Does this blanket contain zinc ammonium chloride?

Mr. Paterson: Right. It is basically a combination blending of inorganic chloride.

A Member: You mentioned the savings in dross from the use of the blanket. Ordinarily dross is formed by the reaction of the iron with the zinc. Exactly how is that prevented? If you are prefluxing, don't you use a sulfuric acid pickle and then preflux in an active solution of ammonium chloride or something like that?

Mr. Paterson: It is the standard method. Your dross is formed by the combination of iron and zinc. Usually the iron is introduced through salts, however, and in the case of an acid flux, you are introducing films of ferrous chloride on the wire as it comes in. If you are bringing it in through the blanket preflux or a standard zinc chloride you tend to minimize that dross formation.

A Member: In other words, the first flux you were talking about was a solution of hydrochloric acid?

Mr. Paterson: No, you are using your sulfuric acid, of course, in your No. 1 bath and you are following it with your flux bath which is an aqueous solution of blanket crystals themselves and in the form of your inorganic chlorides which are pulled out on the wire as a coating both to replenish the blanket and to prevent or minimize the formation of the iron chloride that you get normally with your muriatic acid action.

A Member: You showed us wire or strip. In using it for hardware work where you use baskets, is this material hard to move backwards? Does it interfere with operations?

Mr. Paterson: Normally we consider it for use on continuous galvanizing. However, it has been used in dip-galvanizing, but as you surmise, it is necessary to draw your work through a clean section of the pan. In other words, if you would pull it up through the blanket you would be coating the stock with chlorides, which is objectionable.

A Member: How does this flux differ from No. 20 flux?

Mr. Paterson: I don't know the formulation of No. 20.

A Member: It is a zinc ammonium chloride, together with a bonding addition and a few other gimmicks that are supposed to be secret.

Mr. Paterson: Basically the formation on the crystals has come about by the operating temperature. The zinc ammonium chloride does not have a long life on a spelter pan at 900° F. and we have modified the formation with the higher melting point chlorides to give us the extent of life that is required. That was one of our main difficulties. We have had this blanket for fifteen years or so. We had a devil of a time holding them liquid more than a week or so, and with the modification of the other inorganic chlorides we have been able to hold it fluid with the regenerative bar of the additional flux coming into the bath.

Chairman Crewe: Is Frank Weis here? He has had some experience with this blanket. Frank, do you have anything to say about it?

Mr. Weis: Nothing, Red. We have had some experimental runs of about one month. The indications are good. The test is incomplete.

Chairman Crewe: Mr. Sanderson, have you any comment?

Mr. Sanderson: We have one frame running. I would say the test is still incomplete. I should like to substantiate what Pat has said. Your men have to work on these units that are using this flux. Don't forget to ventilate well. With the shortage of zinc it will be quite interesting to try it out.

Chairman Crewe: If you want to get your nails to where they are going and be sure they get there in good condition, you are going to be very much interested in what Richard E. Oas has to say. He is Sales Promotion Manager of the International Paper Company, Chicago, Illinois. We are delighted to have him with us.

(Mr. Oas presented his paper on "Paper Cartons for Nails.")

Chairman Crewe: This looks like a very interesting development to me. I know you all must have some questions concerned with it.

A Member: I should like to ask two questions. One is what effect, if any, does the atmosphere of the storage room have if you pile these in the warehouse and leave them for a considerable length of time? Do they have a tendency to crush?

Mr. Oas: That question can best be answered this way. In order to palletize successfully over a considerable length of time and over various conditions of humidity it is necessary to build inherent strength into the container better than 100 per cent of the safety factor than you have predetermined you will need. Suppose the safety factor you have determined you need is 1500 pounds. Then you will build into your package 3,000 pounds. Corrugated fiber, like wood, like metal or anything else, will become tired and is subject to fatigue in varying degrees. Our problem in developing this type of package was to develop a container that would be suitable for use in general distribution channels of the nail industry. It had to be a container of a type that would be in common supply. It had to be a container that would resist prolonged abuse. The tests we underwent in this proved conclusively right from the start that a square type of container, of a double sleeve construction, with one piece top and bottom, would be the type we would have to use.

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MEETING
WEDNESDAY, OCTOBER 24th
NON-FERROUS SECTION

Morning Session—9:30 A. M.

Program Chairman: Frank R. Nichols, Pres., Nichols Wire & Aluminum Co., Davenport, Ia.

PAPER:
"The Aluminum Situation."

Describes the factors currently affecting the current civilian supply of aluminum and what is being done to improve the future supply.

by J. H. DeKlyn, Mgr., Massena Operation
The Aluminum Co. of America
Massena, New York

PAPER:
"How Development and Research Have Created New Markets for Nickel Base, Nickel Chromium and Chromium Iron Alloys."

Paper will show why both development and production of these alloys can best be done by a small producer.

by D. M. Schmid, Vice Pres. & Gen. Mgr.
Alloy Metal Wire Co., Inc.
Prospect Park, Pa.

Mr. Nichols: It is a pleasure to be chairman of this meeting, and I am very pleased to introduce Mr. J. H. DeKlyn, Works Manager of the Massena Operations for the Aluminum Company of America. Mr. DeKlyn's paper is entitled, "The Aluminum Situation".

(Mr. DeKlyn delivered his talk.)

Mr. Nichols: That was an interesting talk of Mr. DeKlyn's. I know there are many questions which you people on the floor would like to put. By all means, ask any questions.

Mr. DeKlyn: Of course, the paper is largely a forecast, but we thought that anybody who has anything to do with non-ferrous materials, the shortage of copper and the increasing prospect of a further shortage of copper, would be interested in what the aluminum situation is and what it will be in spite of the present gloom which envelopes some of the people that work with aluminum. The predictions in this paper are accurate and you can absolutely be certain that more aluminum will be available in the years to come; not too many years away, either.

Mr. Nichols: Jack, how long prior to this emergency did Alcoa detect a definite trend toward electrical conductor wire from copper?

Mr. DeKlyn: I am going to ask Mr. Miller who is our rod, wire and bar product manager to answer this.

Mr. Nichols: Any significant trend, Dave, prior to this emergency at the present time. Because of the very acute copper shortage, the people in Washington are directing a lot of aluminum into electrical conductors.

A Member: I think in the early twenties we took the real swing toward aluminum for high voltage lines. As copper became short in supply—that is only within the past eight months—there has been such a swing on the part of the Government agencies away from copper toward aluminum wherever substitution can be made.

Mr. Nichols: Without question, the biggest potential for aluminum wire and rod is for electrical conductor purposes. You mentioned in the course of your talk that more people getting into this will expedite the development of aluminum conductors. How serious is this problem?

Mr. DeKlyn: I don't think it is serious. I think it is one of steady development and research.

Mr. Nichols: Has there been any substantial improvement in the technique in the past ten years?

Mr. DeKlyn: Are you talking about fittings or small wire, or what are you talking about?

Mr. Nichols: Just generally.

Mr. DeKlyn: There has been a very definite increase in the properties, design and efficiency of aluminum fittings for transmission work, and that goes for small wire as well as for large stranded cable.

Mr. Nichols: Shortly after the war ended there was a considerable amount of publicity and comment in connection with the use of aluminum for house wiring, and then to some extent, I think the interest waned and died out; I wonder if you have any comment on that.

Mr. DeKlyn: I think that possibly the production, and I will ask Dave to check me on this, of aluminum for house wiring rather ran ahead of the development of efficient fittings, but that has been overcome.

Mr. Nichols: Let me ask you one more question. In connection with the allocation of metal by Washington to aluminum wire for electrical conductor purposes, are they also doing more about house wire?

Mr. DeKlyn: I think they are encouraging it, but I don't know what they are doing in the way of allocation. I will ask Dave to answer that.

A Member: There are substantial tonnages being allocated by the copper division for applications other than high voltage overhead transmission lines. I speak now about insulated wire for building, service drops, magnet wire, small bus and applications of that sort. There has been a very definite trend on the part of the National Production Authority to substitute aluminum for copper in those fields.

Mr. Nichols: Is there someone here from the copper wire producers that might be interested in this? The statement has been made by people who are very highly placed in Washington to the effect that copper shortage is going to exist for some time. I think everybody in this room has had the experience that sometimes what is said in Washington does not always square with the facts. Is there any practical comment that somebody in the copper industry here would like to make at this time with respect to the copper situation. Do we have any copper men here?

A Member: I think both of you gentlemen have stated the facts correctly. We noted the trend toward aluminum definitely during the Second World War, and the use of aluminum for power line, of course, you all know that that had started in Germany during the first war, and at the end of the First World War, there were practically no copper overhead transmission lines left in Germany. All the copper had been taken down and very few of those lines were put back into copper.

As to house wiring, I think the first intimation that we had on that was the U. S. Rubber Company started the trend toward the use of aluminum for house wire, and it has carried on quite steadily.

Now, as to the copper situation, I think that the statements have been mild. I think it is going to be even a great deal worse than you have indicated. It might be of interest to you gentlemen to know that the United States has allotted approximately 333,000 tons for the last quarter, and that is in excess of the United States production. We shall have to get somewhere between 50,000 and 75,000 tons elsewhere. That is not going to be so easy. There just isn't enough copper; and we have another very interesting situation in Chile. Before that country consented to go into the international arrangement they demanded twenty percent of that copper be given to them to be used in whatever way they wished, and they have had the great success of selling that copper anywhere from fifty to sixty cents a pound against our price in the twenties. Not so much of it has come here. I know some Swiss concerns who were willing to pay sixty-one cents a pound for copper.

Mr. Nichols: I would like to ask whether copper is still going, by and large, into electrical conductors or have there been new uses that have cut into the supply available for electrical conductor work?

A Member: The answer is yes and no. The reason for that is that the are still a great many demands for copper. Many engineers have indicated that they would not want to change unless forced to. From a practical or theoretical standpoint, I should imagine aluminum can be substituted in almost every case, but I would still say some 90 percent of the electric motors are still made with copper windings. Perhaps the gentlemen of the aluminum industry would know more about what sort of conductors are used. A great many other uses are still left. as for copper tubing. In one of our affiliated companies, we simply cannot make enough copper billets for copper tubing.

Mr. Nichols: So actually, what is taking place is that the electrical industry has grown to such an enormous extent that it has really by-passed copper production or has gone past copper production substantially and consequently, aluminum must be used in greater quantities. However, there still are sufficient places where copper is desirable and better than aluminum, so you still haven't got enough copper.

(*Please turn to page* 102)

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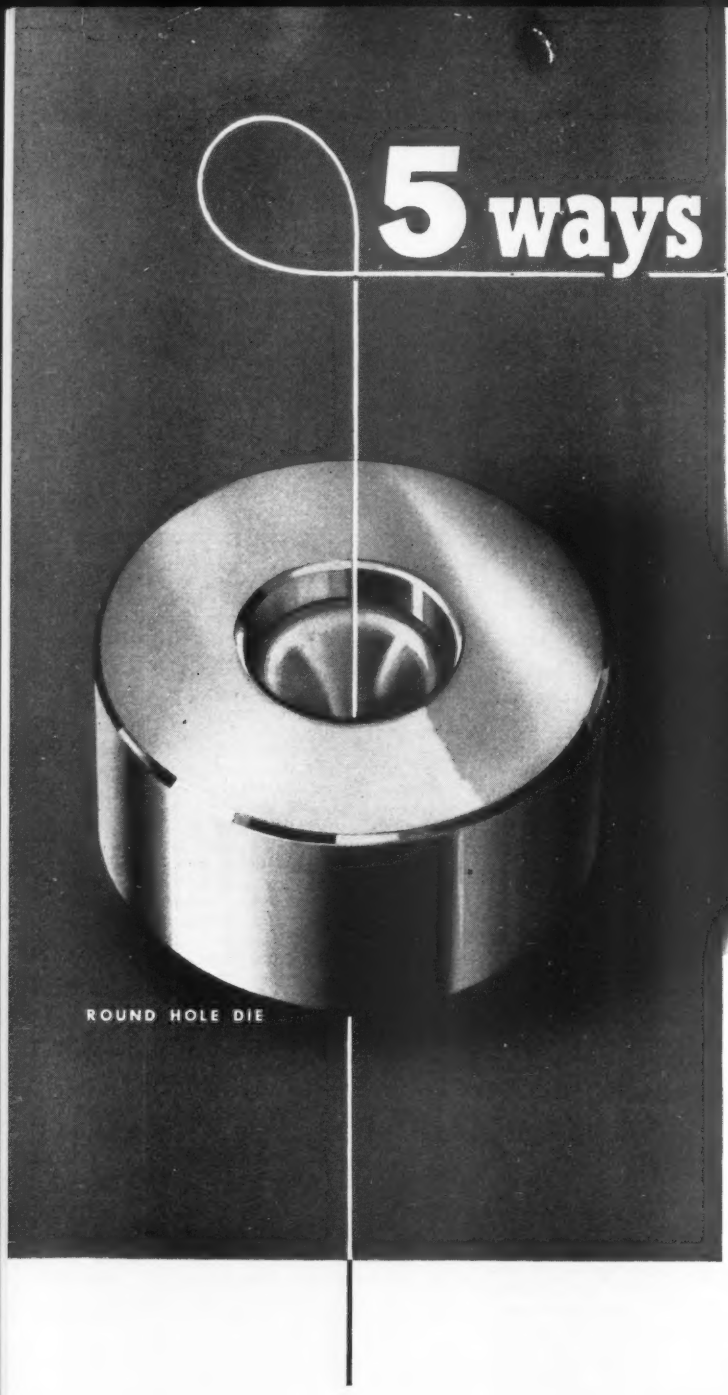

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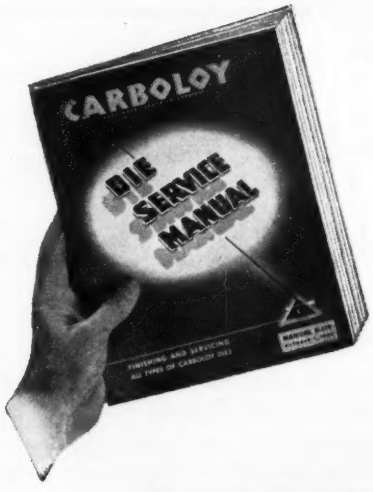


CARBOLOY

DEPARTMENT OF GENERAL ELECTRIC COMPANY

11171 E. 8 MILE BLVD. • DETROIT 32, MICHIGAN

Government Wire Production Information

Copper Order M-16 Modified To Keep Mills Going

The National Production Authority has modified its basic copper raw materials order to permit brass and bronze foundries, wire mills and brass mills to obtain supplies of copper raw material in advance of their receipt of monthly NPA allocations.

★ ★ ★

Direction 1 to Order M-16, issued Nov. 19th, permits persons with authority to purchase copper raw materials to place advance orders for and accept delivery on the first of each month of up to 50% of the quantity of similar materials they were authorized to use during the previous month.

★ ★ ★

Heretofore, users of copper raw products were not permitted to place orders for or accept delivery of these products until they had actually received their monthly allocation. NPA each month makes allocations of copper raw materials, separate allocations being made to each wire mill, brass mill and foundry. There was often a considerable delay between the time an order was placed and actual receipt and users of copper raw materials were put at a disadvantage, as some did not receive the copper for several weeks after they were authorized to receive it.

★ ★ ★

All users of copper raw materials who received allocations in November will now be permitted to place orders for receipt December 1st of up to 50% of the amount of raw copper they were authorized to purchase in November. In future months they will continue to have this advance purchase authorization.

★ ★ ★

The authorization does not apply to the small and intermediate brass and bronze foundries whose authorization to purchase covers a period longer than one month.

IAC Meeting on Zinc

Problems confronting the zinc industry and the government in dispelling shortages of the critical metal which loom next year and through 1955 were discussed at the first meeting of an Industry Advisory Committee to the Defense Materials Procurement Agency on Nov. 15th.

★ ★ ★

Industry officials were advised of projected requirements through the currently scheduled mobilization program and invited to offer suggestions for plans which will lead to expanding present mining facilities and opening of new deposits, foreign and domestic.

★ ★ ★

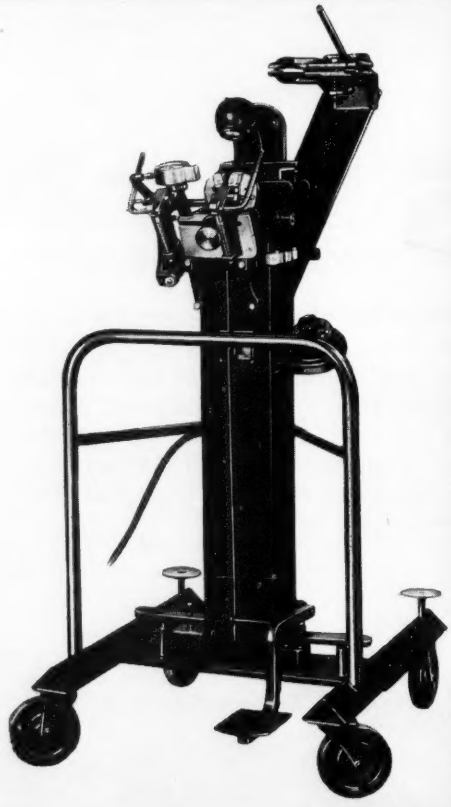
The situation with respect to the projected supply of zinc was described by Howard I. Young, Deputy Administrator of DMPA, as being "extremely serious when you look at it against the policy of supplying not only the mobilization effort but

MICROMETER PRECISION — MICRO-WELD — TRADE MARK REGISTERED

MODELS J-3-C and J-4-S AUTOMATIC MICRO-WELD BUTT WELDERS

These welders are used for welding high and low carbon STEEL, and STEEL ALLOY wire, ranging in size from .020" to 1.60" diameter. All operations on these units, which include the clamping of the wire being welded, contacting the welding switch, and upsetting the weld, are made by a single downward stroke of the foot pedal. Welders for high carbon steel wire are equipped with the exclusive MICRO-WELD Dial indicating annealing device to facilitate the annealing operation of high carbon wire.

Standard equipment with these units include annealing dies, filing vise, light extension cord, and mounting on a 4-wheel truck. Special units can be furnished for crane mounting.



MICRO PRODUCTS CO.,

20 NO. WACKER DR., CHICAGO 6, ILL.

Telephone: STATE 2-7468

keeping the national economy going at the highest possible level as well."

★ ★ ★

The DMPA is now in the process of formulating a zinc program, based upon its own studies and the opinions given it by industry. Mr. Young said a plan of action will be announced "in the near future."

★ ★ ★

New Copper Production Arranged For

Another step to assure the nation of long range supply of domestic copper has been taken by the Defense Materials Procurement Agency when an agreement was signed with the American Smelting & Refining Company underwriting new production of 197,000,000 pounds over a 5½ year period.

★ ★ ★

The Company will expand its Silver Bell Mine facilities, located in Pima County, Arizona, with a $17,000,000 development. Annual production is expected to be around the 36,260,000 pound mark. Under the agreement, the Government will take up to 177,000,000 pounds of the first 197,000,000 produced, if the Company is unable to sell it at the guaranteed price.

★ ★ ★

After 5½ years from the date production begins, the Government's responsibility to purchase expires, but the steady source of copper will continue as experts believe the area good for 12 years' yield. Production will get underway within 2 years.

★ ★ ★

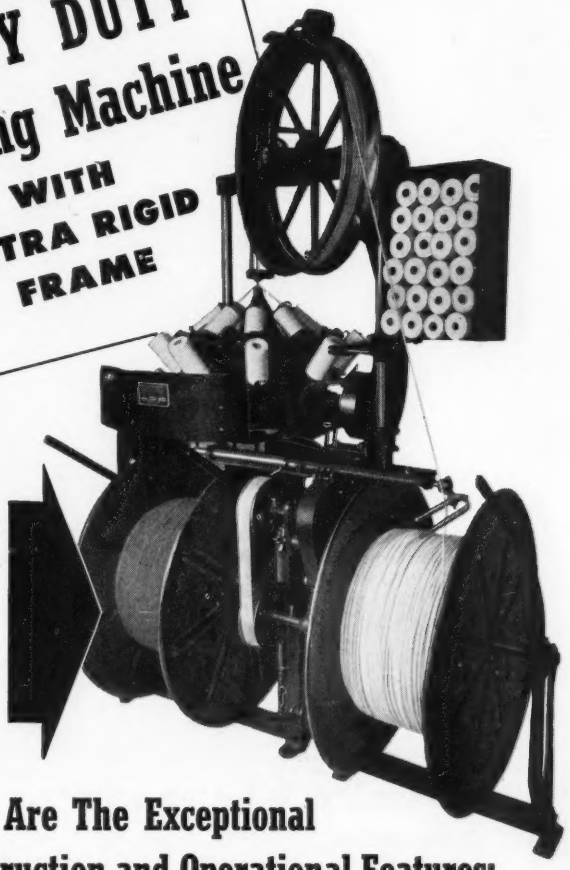
A New Year Resolution

Scrap is sorely needed—steel, copper, brass, aluminum. Shortages in available scrap are hampering the production of metal that **you** need to keep your mills going. It is believed that there is plenty of scrap lying around that, if salvaged and turned into the normal channels that sell scrap to the basic metal producers, there would be no shortage of this vital material.

★ ★ ★

Tremendous quantities of scrap have been dug up by many concerns, but it needs to be a 100% job. What better resolution for the New Year, therefore, to do your bit toward looking up scrap about your own plant—even old and obsolete equipment will help—and getting it into channels where it will do some good!

16 CARRIER HEAVY DUTY Braiding Machine WITH EXTRA RIGID FRAME



Combines the advantages of a 24 carrier side delivery braider and proved economy of 16 carrier head.

Especially designed for manufacture of non-metallic, service entrance, metal shielding and other types of material.

Here Are The Exceptional Construction and Operational Features:

- A 16 carrier head equipped with a 13/16" diameter beater opening on a 24 carrier frame.
- Aids in windup of finished product onto the reels. A more efficient windup of finished product on reels, as with 24 carrier braider.
- Flat belt friction wheels windup with foot treadle and adjustable tension spring has proved most practical.
- Reel tension can be increased or decreased by operation of foot treadle.
- Large diameter of 24 take-up wheel requires less tension for bending larger cores or solid wire.
- This braider can be furnished to use reels up to 36" diameter x 22" outside width.
- Supply packages: 4" traverse, 2 11/16" diameter on upper carriers; 5" traverse, 2 11/16" diameter on the lower supply carriers.

WARDWELL BRAIDING MACHINE CO.

Central Falls Rhode Island, U.S.A.

Representatives for Europe, British Colonies and Dependencies

JAMES MACKIE & SONS, LTD., BELFAST, IRELAND

JOHNSON is a wire specialty plant, not a tonnage mill. Every Johnson wire is drawn under close laboratory supervision, resulting in the specific wire for its intended use. Johnson goes in for top quality and ease in processing.

Music Wire—"The wire of a thousand uses" . . . Brush Wire . . . Aircraft Cable Wire . . . Vacuum Hose Wire . . . Hose Reinforcement Wire (braided type) . . . Tire Bead Wire . . . Johnson Stainless Steel (18-8 grade, types 302 and 304) comes to you with lasting harmless lubrication (not to be removed).

JOHNSON

STEEL AND WIRE COMPANY, INC.

WORCESTER 1, MASS.

New York Philadelphia Cleveland Detroit Akron Chicago
Atlanta Houston Tulsa Los Angeles Toronto

Business Forecasts for 1952

(*Continued from page* 50)

necessity of placing National Defense ahead of all other factors.

★ ★ ★

Actually the copper squeeze will be affected in the next few years by a continuing growth in demand. The demand for copper increases with the growth of population and the increase in National Income. In other words—as people have more money to spend they buy more automobiles and electrical appliances and the other good things of life. As the population increases, people need more housing and hence need more brass for hardware and copper tubing and sheet metal. Now, from the historical point of view, you know that both the population and the National Income of this country have always gone in one direction only—and this is up. Economists believe that it will continue that way. So, as the number of people increases and as their incomes increase —the demand for copper will increase.

★ ★ ★

Many will remember the shortages of materials, including copper, in 1948 when business reached a postwar high. Yet in the spring of 1949, we had an inventory depression on most commodities and copper became readily available on short notice. It could happen again, except for NPA restrictions on inventory accumulations. Such accumulations are hardly possible with the careful allocation and policing system now in effect. Some of you are acquainted with the recent forecast of a well-known organization which insists that business will reach a postwar peak in the spring, and thereafter dip rather sharply into a two or three-year business recession. So the present copper situation could shake itself loose—and we might find ourselves selling copper instead of rationing it.

★ ★ ★

Stockpiling by the Government has, of course, eaten into the amount of copper that would otherwise be available for today's production. The amount in the Government stockpile has never been officially stated, but it has frequently been estimated as around 500,000 to 600,000 tons. It is intended to be used only in the case

of a real national emergency. Last August the Government stretched a point a bit and authorized a withdrawal of 25,000 tons as a loan to compensate for production lost during the July smelter strike in Utah. On September 29, it was announced than an additional withdrawal of 30,000 tons had been authorized to replace the loss in production due to the more recent 2-week industry-wide copper strike. However, regarding the stockpile—let us keep this one fact in mind. If estimates of the size of the stockpile are correct, it is roughly equivalent to one year's imports and makes this nation self-sufficient for that length of time only.

★ ★ ★

Now I want to leave you a few bright spots in the picture.

★ ★ ★

First—while there is at the moment a world shortage of copper, the Western Hemisphere as a whole is self-sufficient and promises to remain so for a long time.

★ ★ ★

Second—we never can be sure that new discoveries and, more especially, improved mining technology will not come along to increase our own copper reserves and copper production. It has always happened so in the past. A hundred years ago the average grade of ore mined in this country was 20%.

★ ★ ★

In 1938—a U. S. Bureau of Mines Bulletin estimated that copper reserves would last 25 to 30 years at current consumption levels and yet today's estimate—13 years later and after a major war—would show our reserves to be about the same.

★ ★ ★

And third—the United States for the last century has been and still is the world's largest producer of copper. Enormous quantities of copper still lie within our mountains and deep within our rocks. You can be sure that no effort will be spared to move this copper out of the rocks and mountains and into the production pot of American industry.

★ ★ ★

—by Ralph K. Clifford, President Continental Steel Corporation

Steel wire, the production of which constitutes a very important segment of our steel industry, has

REELS

WOOD REELS
FOR
CABLE, ROPE
AND WIRE

PLUS A SPEEDY SHIPPING SERVICE

If your mill is located within 200 miles of Hazardville, BRIDGE trucks will deliver reels to your door — overnight, if necessary.

Fast freight service will reach points as far away as St. Louis in 4 or 5 days. Even better deliveries to points like Buffalo and Cleveland. If shipped via fast LCL rail service, reels will be delivered to your door in some cities *at no extra cost.*

BRIDGE REELS are made in RETURNABLE and NON-RETURNABLE types in sizes from 12" to 96" in diameter. Furnished knocked down or assembled for SHIPPING or SHOP use. Also, REEL HEADS for STEEL DRUMS.

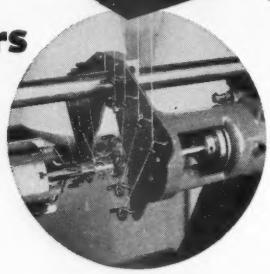
You are invited to avail yourself of our unique service. Visit our plant and see how BRIDGE'S REELS are made and why they are so sturdy and low in cost. .....

BRIDGE
MANUFACTURING CO.
HAZARDVILLE, CONN.
Phone Thompsonville, 4928

INCREASE YOUR BUILDING AND WEATHERPROOF WIRE PRODUCTION . . .

10-15 times with Fidelity SINFRA wire and cable knitters

Fidelity Sinfra Knitter and Haul-off Reel Stand



Enlarged view of Knitting Head

- Less Yarn Cost
- 15 Times Productive Output
- 600% Greater Labor Productivity
- Less Floor Space
- Lower Maintenance
- Lower Power Requirements
- Complete Automatic Control
- Minimum Noise
- Easier Working Conditions
- Accepted by ASA, AAR, UL, CSA
- Lower Capital Investment

The production of *one* FIDELITY SINFRA wire covering machine is equivalent to the capacity of 15 triple deck braiders! This impressive production achievement is made possible by the reliable and extremely high speed Fidelity Knitting Head, using stationary, large yarn cones.

The SINFRA Knitter is built to the precision standards long associated with Fidelity and is equipped with automatic electric stop motions, controlling both the wire and yarn supply. As the wire enters the SINFRA Knitter it is straightened by a unique straightening device before being passed through a series of 3 knitting heads.

SINFRA Knit is widely acclaimed as the most modern method of covering wire. Wire covered by SINFRA Knit is accepted by the American Standards Association, Association of American Railroads, Underwriters' Laboratories, Inc. and the Canadian Standards Association.

SINFRA Knitter is designed to permit horizontal operation at normal working level. No longer need your operators crawl or stretch to service wire covering equipment and noise level is reduced to a pleasing hum. Top companies have found their answer to production in SINFRA Knitters. Why not write for complete information on this development to lower your production costs and increase your productive capacity.

Write today for literature on this time and money saver.

Manufacturers of intricate precision machinery since 1911.

FIDELITY MACHINE COMPANY INC.

3908 FRANKFORD AVE. • PHILA. 24, PA., U.S.A.

not at any time since the beginning of Korean hostilities, been in quite such short supply as many other steel items such as sheets, plates and structurals.

★ ★ ★

For this reason and because wire producing facilities are more nearly in balance with demand, it is likely that wire will be one of the first important basic steel products to catch up with the market.

★ ★ ★

It would not be surprising if such a condition would be reached early this year. As long, however, as there is no real business recession there will be a good steady demand for wire and wire products.

★ ★ ★

by K. R. Beardslee, Gen. Mgr. Carboloy Department of General Electric Co.

Reports indicate that there will be an increased demand for wire and wire products in 1952. Although carbides contain strategic materials and as such should be conserved for contingencies, at the present time it appears that a sufficient supply of carbide dies will be available for the increased needs of the wire industry in the coming year. It is essential, however, that all users of carbides get maximum efficiency from their use. To help the wire industry accomplish this, our organization will continue and expand its training activities both in the field and in our die training school maintained at Detroit.

★ ★ ★

There is considerable interest at present in the wire and wire products industry with regard to the recently announced chrome carbides. Certain characteristics of chrome carbides as compared with tungsten carbides have raised the question of the possibility of using these newer carbides for die work. Experimental investigations have not progressed sufficiently as yet, however, to permit any forecasting as to whether the new carbides will find a major place in the wire industry.

★ ★ ★

by A. F. Metz, President The Okonite Company

The demand for copper wire cable products in 1951 reached extremely high levels. This situation combined

with a pronounced shortage of copper has resulted in a very large total of undelivered orders and extended deliveries.

★ ★ ★

Direct government defense requirements have only taken a modest share of available facilities although practically all of the industry has a large volume of orders for defense-supporting requirements such as those for light and power utilities, large industrials and railroads. Further, electricity continues to enhance our standard of living and an increasing portion of the civilian demand has become a necessity ranking with defense. During 1951 all major raw materials have been placed under controls.

★ ★ ★

COPPER—Copper is definitely the limiting factor in the production of copper wire products. The world supply is now under controls and the quota for the United States is about 50% of the world supply (approximately 330,000 tons per quarter). While there are several programs for increasing copper supply, they will not make any more copper available during 1952.

★ ★ ★

Though the price for copper in 1951 covered a very wide range, controls now have produced a more orderly market at 24½¢ per lb. for domestic copper and 27½¢ per lb. for imported Chilean copper. In the allotment program for copper wire fabricators, every effort has been made to divide available supplies equitably.

★ ★ ★

Fabricating facilities, however, are probably only being used to the extent of 60% to 70% of practical capacity. Aluminum as a substitute for copper has therefore taken on a quickening interest and is being offered by many of the wire manufacturers. In addition some of the aluminum producers have entered the insulated wire fabricating industry. Therefore, it seems highly probable that as aluminum production increases, this metal will be more frequently used as an alternative to copper for conducting electricity.

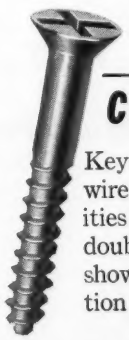
★ ★ ★

The use of electricity continues to grow far beyond the ability of domestic copper production to sup-

To make certain Keystone Wire measures up to your specifications, rigid quality controls are maintained throughout its manufacture.

In addition to metallurgical and chemical tests, the wire undergoes further checks in Keystone's Physical Testing Laboratory. Diameter tests, tensile strength tests, torsion tests, bend tests, and microstructure tests assure absolute uniformity in every shipment.

KEYSTONE



"SPECIAL PROCESSED"

COLD HEADING WIRE

Keystone's "special processed" cold heading wire has uniform upsetting and forming qualities plus excellent flow properties which often double plug and die life. Production reports show less waste, fewer rejects, reduced inspection time and a higher quality finished product.

More SCRAP today . . . More STEEL tomorrow!

Keystone Steel & Wire Company
PEORIA, ILLINOIS

specify

SENECA

ROUND AND FLAT

SPRING WIRE

Whatever your spring wire requirements—consult with Seneca! Our production *geared to precision* in manufacturing oil tempered and hard drawn wire—round and flat—for all types of high grade mechanical springs. You'll find that Seneca uniformity and dependability help the spring manufacturer produce high quality springs at low cost. Make Seneca your headquarters for all needs in Quality Wire.

Seneca

WIRE & MFG. COMPANY • FOSTORIA, OHIO

Representatives in practically All Principal Cities

ply copper sufficient for its proper distribution. Since more and more power is required to sustain the living standards for which we are striving, copper wire products should be distributed to defense and civilian needs on a basis that will support a fair level of living standards. The resourcefulness of fabricators will have to measure up to a high standard if we are to secure both volume and quality of product.

★ ★ ★

OTHER MATERIALS — While copper still limits production of copper wire products, other materials may cause restrictions. Rubber and rubber substitutes have become more available but other basic materials and chemical ingredients of insulating compounds (such as sulphur and zinc) are in tight supply. Especially critical are tin and lead. Only a fraction of lead requirements have recently been available. Domestic strikes and the decline in imports are responsible for the shortage. The substitution of aluminum for lead sheaths on electric cables has taken on an active interest and there have been some very extensive developments in this field. It is quite probable that aluminum sheaths will supplant lead to a considerable degree in the not too distant future.

★ ★ ★

SALES—The uncertain international picture together with the consequent increasing government control of industry places heavy responsibilities on sales executives and their staff. This group is the spark plug of all American business. Any let-down in the tradional aggressive character of American selling will produce dire results which cannot help but pave the way to socialism. It seems to this writer that every device that stimulates competition must be put to good use. Service, quality and new products are such items. It is difficult to maintain aggressive competitive policies in the face of excessive demand for our products. The status-quo attitude prevalent under today's conditions discourages a strong sales effort and too much emphasis cannot be placed on the necessity for maintaining a high pitch of activity and enthusiasm in selling.

★ ★ ★

TAXES—It is becoming quite evident that tax rates are now so high that many in Congress are unwilling to consider increases. It is also evident that rates have reached deeply into the realm of diminishing returns and that the punitive effect of such progressive taxation is materially reducing opportunities for new venture capital and growth of small business. Increasing interest therefore is being shown in the effort to place a 25% limitation on tax rates for income, inheritance and gifts. A recent Gallup poll indicates that with 11% having no opinion, **59% of our people are in favor of restricting federal income tax rates to 25%.** As this seems to be the starting point of diminishing returns, the proposals is far sounder than the present unlimited progressive tax which, incidentally, is the first tenet of the Marxian Communist Manifesto to bring about Socialization. Within a reasonable period of time, a 25% tax return should produce more revenue on an economically sound basis and very materially increase national income and productive jobs. I hope that readers will come to realize what a bulwark to our free economy tax limitation can be!

★ ★ ★

CONCLUSION—All of the elements for a hopeful year in 1952 for copper wire and cable are at hand —a favorable backlog of orders together with an increasing demand for defense materiel, a fair supply of raw materials (including substitutes) an area of competitive activity to stimulate selling and some opportunity to take a hand in a **sane American plan** of taxation instead of the European-born, progressive, confiscatory policies now adhered to by our federal government.

★ ★ ★

Opposed to these elements are the danger of increasing government controls, of unwarranted satisfaction with present conditions and of the ever present and expensive international crisis which will continue until we secure a strong and respected State Department. The shape of our future can be considerably altered by a competent attitude on the part of the electorate in the 1952 elections.

★ ★ ★

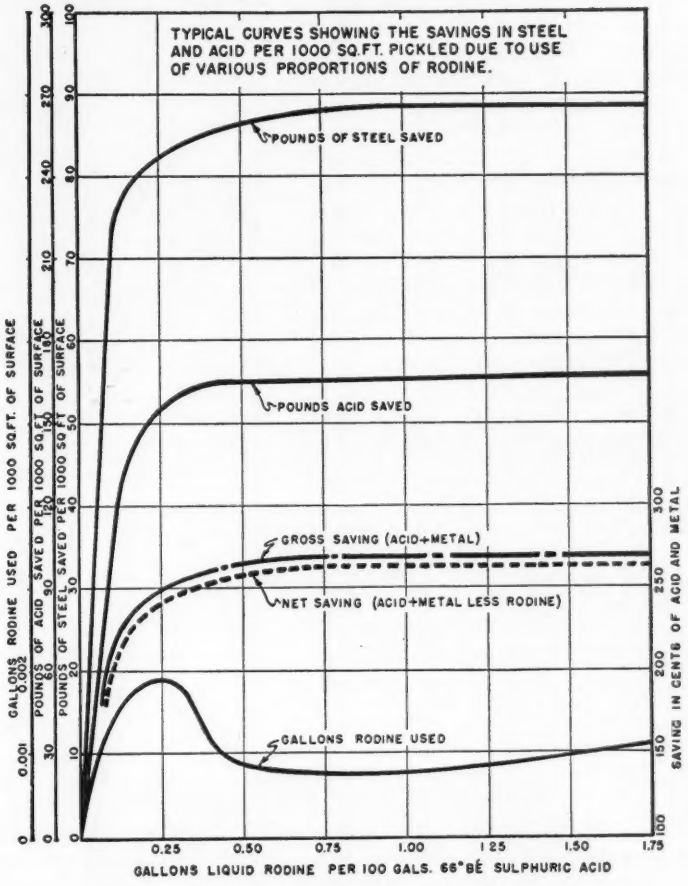
AMERICAN CHEMICAL PAINT COMPANY

AMBLER CHEMICALS ACP PROCESSES PENNA.

Technical Service Data Sheet

Subject: EFFICIENT PICKLING WITH "RODINE"®

A. SAVINGS POSSIBLE WITH "RODINE"


TYPICAL CURVES SHOWING THE SAVINGS IN STEEL AND ACID PER 1000 SQ.FT. PICKLED DUE TO USE OF VARIOUS PROPORTIONS OF RODINE.
POUNDS OF STEEL SAVED
POUNDS ACID SAVED
GROSS SAVING (ACID+METAL)
NET SAVING (ACID+METAL LESS RODINE)
GALLONS RODINE USED
GALLONS RODINE USED PER 1000 SQ.FT. OF SURFACE
POUNDS OF ACID SAVED PER 1000 SQ.FT. OF SURFACE
POUNDS OF STEEL SAVED PER 1000 SQ FT OF SURFACE
SAVING IN CENTS OF ACID AND METAL
0.25 0.50 0.75 1.00 1.25 1.50 1.75
GALLONS LIQUID RODINE PER 100 GALS. 66°BÉ SULPHURIC ACID

B. TYPICAL APPLICATION OF "RODINE"

Pickling shell cases in uninhibited muriatic or sulfuric acid contributes to their embrittlement and makes it difficult to draw them without breakage. By adding a small amount of "Rodine" to the pickle bath, embrittlement is suppressed and more than enough acid is saved to pay the costs of the inhibitor.

CHEMICALS ACP PROCESSES WRITE FOR DESCRIPTIVE FOLDER ON "RODINE" AND INFORMATION ON YOUR OWN PICKLING PROBLEM. CHEMICALS ACP PROCESSES

Outstanding Personalities of the Wire Industry

James R. Thompson Retires

After a half-century of service with the **American Steel & Wire Company, James R. Thompson,** a national authority on cold heading and one of the deans of his field, retired on November 30 from the position of manager of the company's metallurgical department, **Walter F. Munford,** vice president, operations, of this United States Steel subsidiary, has announced.

★ ★ ★

A native of Cleveland where he attended public schools, Mr. Thompson specialized in the study of chemistry at what is now Fenn College. He first came to the Wire Company in 1901 as a chemist at Newburgh Steel Works in Cleveland. In 1921 he was appointed head chemist at Central Furnaces and Docks.

★ ★ ★

He was named plant metallurgist at Newburgh Steel Works in 1929. In 1934 Mr. Thompson was transferred to the vice president's office to assume responsibilities in the cold heading wire division. Three years later he was promoted to assistant manager of the metallurgical department and in 1942 he was named manager of the department, a position he now relinquishes.

James R. Thompson

★ ★ ★

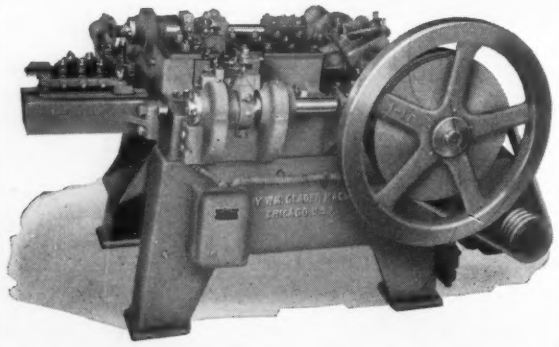
Mr. Thompson is a member of the American Iron & Steel Institute and is chairman of the rod and wire committee and serves on the general technical committee of that organization. He also is a member of the Society of Automotive Engineers, the American Society for Testing Materials, the American Society for Metals and The Wire Association, of which he has been a director.

★ ★ ★

General O'Connell New Deputy Chief Signal Officer

Brigadier General James D. O'Connell has been assigned Deputy Chief Signal Officer as of December 1, to replace Major General Kirke B. Lawton, who will be assigned as Commanding General of Fort Mon-

GLADER HIGH SPEED WIRE NAIL MACHINE



MACHINE ARRANGED FOR INDIVIDUAL MOTOR DRIVE

High tonnage output, and low maintenance costs, have resulted in Glader Machines being accepted as standard equipment in every large nail mill built in the United States in the past twenty years.

Glader Machines are operating in most of the wire producing mills throughout the world.

These machines are made in eleven different types and sizes. This enables us to cover the range of sizes of nails produced with the greatest efficiency.

For further information please address,

WM. GLADER MACHINE WORKS
210 No. Racine Ave.
Chicago 7, Illinois

Export Dept.: 122 E. 42nd Street, New York 17, N. Y.

mouth, New Jersey.

★ ★ ★

General O'Connell had been assigned to Special Assignment Group, Boards and Committee, in the Office of the Chief Signal Officer since August, 1951.

★ ★ ★

Osborne, Turner Advanced by Westinghouse

Two vice presidents of the **Westinghouse Electric Corporation** have been assigned new duties in a move designed to expedite the Company's defense activities, **Gwilym A. Price**, president. announced recently.

★ ★ ★

L. E. Osborne, formerly vice president in charge of manufacturing, has been named to the newly created post of executive vice president—defense products. Mr. Osborne has been assigned responsibility and authority for all defense efforts of the Company.

★ ★ ★

Tom Turner, vice president in charge of labor relations, retains that post and also assumes the manufacturing responsibilities that were formerly assigned to Mr. Osborne. His new title will be vice president in charge of manufacturing and labor relations.

★ ★ ★

Barrett Made P. A. for American Steel and Wire

Roger W. Barrett has been appointed to the post of purchasing agent for **American Steel & Wire Company**, succeeding **Frank E. Chesney**, who has retired.

★ ★ ★

He first joined the Wire Company in 1926 as a clerk in the mechanical department at Worcester North Works. After completing his university education he was made a rod schedule clerk at North Works.

★ ★ ★

Following a series of promotions he was transferred to the purchasing department at the company's Cleveland offices in 1937. Three years later he was appointed a buyer and in 1945 was named assistant district purchasing agent. Later that year he was promoted to assistant to purchasing agent. In 1946 he became assistant purchasing agent and in April 1951, was named senior assistant purchasing agent, a position he has held since that time.

★ ★ ★

Steel Company of Canada Appointments

H. M. Griffith has been appointed assistant to the president of **Steel Co. of Canada; Ltd. M. A. Leishman** made works manager of the company at the Hamilton and Ontario Works; **G. W. Bruce**, assistant works manager; and **A. D. Fisher**, general superintendent. Mr. Griffith succeeds **R. M. Kelday**, recently named manager, wire, wire products and screw division, with headquarters at Canada Works.

★ ★ ★

Jerry Bean starts his 13th year with Apex Alkali Products

Having been a reserve officer in the army, **Jerry Bean** has completed a year of active duty and is now back on the job!

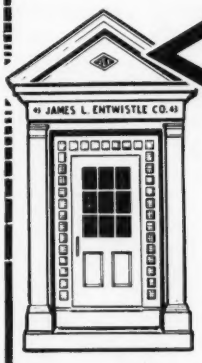
★ ★ ★

He will cover the Southeastern Pennsylvania, Maryland and Delaware territories for Apex, residing in suburban Philadelphia.

★ ★ ★

His many friends in the industry will be glad to see him again.

★ ★ ★



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SERVING THE WIRE INDUSTRY THROUGHOUT THE WORLD

- Standard Sets of Spark-Testing Equipment
- Take-ups and Re-spoolers
- Reelers
- Coilers
- Spoolers
- Collapsible Coiling Reels
- Wire Sparkers and Accessories
- Hand Locators
- Electrode Units and Stands
- Measuring Machines, Counters and Accessories
- Wire Guide Units
- Pay-off Reels Stands
- Electronic Devices
- Conduit Connection Sets
- Wire Pre-Heater
- Disk Brakes and Controls, Drag Units and Slip Clutches
- Wire Marking Machines, Type Strips, Inks
- Labelling Machines
- Pneumatic Equipment and Controls
- Miscellaneous Equipment
- Hydraulic Equipment and Controls
- Hi-Pot Test Sets
- Cable Handling Equipment for Warehouse Use

See page 34 for news of the JLE Re-Spoolers, Class O

JAMES L. ENTWISTLE CO.

1475 ELMWOOD AVE. PROVIDENCE 7, RHODE ISLAND, U. S. A.

European & South American Agents:
M. CASTELLVI, INC.
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C. F. & I. Promotes Metzger

Effective immediately the following personnel changes have been announced.

★ ★ ★

R. E. Metzger has been appointed Assistant to Vice President in Charge of Sales. Mr. Metzger became associated with CF&I in November 1945 as Supervisor, Sales Training; in January 1947 he was transferred to the Wickwire Division working on special assignments for the Vice President in Charge of Sales. He was transferred to The California Wire Cloth Corporation in January 1948 and served as Assistant to General Manager of Sales.

★ ★ ★

Earl F. Arnett Moved To G.E.'s Coshocton Plant

Earl F. Arnett of **General Electric's Chemical Division** has been appointed Manufacturing Engineer for the Coshocton, Ohio, plant of the Division's Laminated and Insulating Products Department, according to an announcement by **H. K. Collins**, Department Manager.

★ ★ ★

Mr. Arnett came with the company in April, 1940 as a chemist in the research section of the new products development laboratory at Pittsfield and in 1945 was transferred to the chemical engineering section of the laboratory. In February of 1949 he was named supervisor of pilot plant operations and in January of this year, was placed in charge of the chemical process development section, which position he held until his present promotion.

★ ★ ★

Jelliff Appoints New Pittsburgh Distributors

The C. O. Jelliff Manufacturing Corporation of Southport, Connecticut, has appointed the **Pennsylvania Industrial Supplies Company, Inc.,** of 856 West North Avenue, as their sole representatives in the Pittsburgh area for all products except electrical resistance wire.

★ ★ ★

The products to be handled by the new distributors include wire mesh, fabricated mesh products, such as filter units, dipping baskets and Lektromesh. The territory, which includes much of western Pennsylvania and parts of eastern Ohio, was formerly covered by the **William M. Orr Company** of Pittsburgh.

★ ★ ★

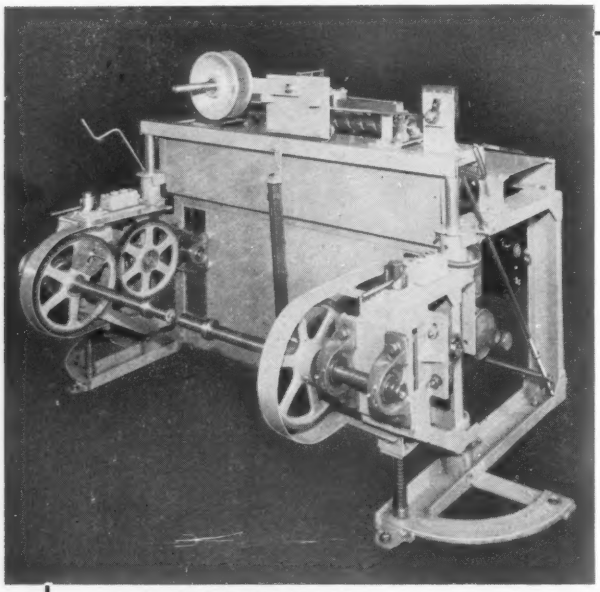
G. E. Changes in Chemical Division

H. Arthur Howe, manager of the **General Electric Chemical Division's** phenolic products plant at Pittsfield, has been appointed manager of the Division's Coshocton, Ohio plant, according to an announcement by Harry K. Collins, general manager of the Laminated and Insulating Products Department.

★ ★ ★

Simultaneously, John L. McMurphy, general manager of the Division's Chemical Materials Department, announced that **Arthur T. Bourgault,** department manufacturing analyst, will succeed Mr. Howe as manager of the phenolic products plant.

★ ★ ★



Use Federal **DOUBLE TAKE-UP** *Equipment*

for efficiency. Equipped with variable speed traverse. Handles 30" reels.

Has wide range of speeds—up to 2500 F.P.M. Heavy steel frame and precision construction assures smooth operation and long dependable service.

FEDERAL EQUIPMENT is neither inflated in price, nor deflated in quality.

Prompt delivery. Priced right.

Write today for details.

Use FEDERAL —

DOUBLE TAKE-UPS
SINGLE TAKE-UPS
CAPSTANS and
PAY-OFFS

Federal Manufacturing Co.

SPECIAL WIRE MACHINERY

236-240 Hall Avenue, Wallingford, Conn.

Glass Fibers Buys Control of Vibradamp Corporation

Glass Fibers Inc. of Toledo, Ohio has purchased controlling interest in the Vibradamp Corporation with headquarters at Los Angeles and plant facilities at Los Angeles and Santa Clara, California. This announcement was made by **Randolph H. Barnard**, president.

★ ★ ★

The newly acquired company utilizes a Glass Fibers' product, lightweight glass wool, in the manufacture and fabrication of specially-designed shock mounts, vibration mounts and other products for defense weapons in addition to many commercial applications. All are made under a patented process and sold under the trade name, "Vibraglass".

★ ★ ★

In making the announcement, Mr. Barnard said, "This acquisition represents the initial culmination of our plan to become a real part of West Coast industry which is so vital to our national economy and preparedness program.

★ ★ ★

Mr. Barnard added that as soon as possible, his company will offer West Coast customers, in addition to the already established "Vibraglass" items, the complete line of "Vitron" glass fiber products. These include glass textile yarns for the electrical and plastics industries so well established on the Coast.

★ ★ ★

By the first quarter of 1952, glass yarn productive capacity will have been increased 200% at Glass Fiber's Waterville, Ohio, plant.

★ ★ ★

Harry Miller in Defense Work

Harry Miller, of **Northern Electric Company, Ltd.** has been appointed associate director of the electronics division, Department of Defense Production, of which **A. H. Zimmerman** is director. Mr. Miller is one of two government-selected representatives of industry currently completing a special course at the National Defense College. He was works manager of Northern Electric's Wire and Cable Division at the time of his selection for the special course.

★ ★ ★

Instrument Society Announces 1952 Conference

The National Instrument Conference and Exhibit to be held in Cleveland, September 8-12 inclusive, 1952 will be the largest and most comprehensive meeting ever held by the **Instrument Society** of America.

★ ★ ★

Floor plans and details on the show have just been mailed from ISA Headquarters, 921 Ridge Avenue, Pittsburgh 12, Pa. to several hundred companies which have a priority on the choice of space due to exhibiting at previous shows.

★ ★ ★

Made V.P., Engineering, of Michigan Wire Cloth

Arthur W. Bull has been elected Vice-President in Charge of Engineering of **Michigan Wire Cloth Company**, Detroit, Michigan. Bull has been Chief Engineer of the company since 1947. Previously, he was Project Engineer at King-Seeley Corporation.

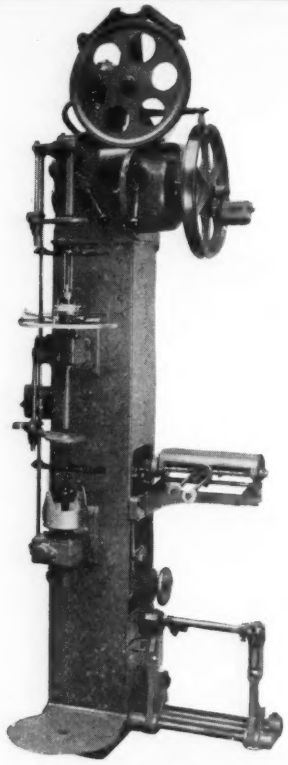
★ ★ ★

WIRE SPOOLS, ALL-STEEL, LITHOGRAPHED

Ends and traverses may be shipped separately and assembled easily in your plant on a hand, foot, or power press.

5" and 6½" diameter ends with 1-15/16" diameter traverses.
10½" diameter ends with 3½" diameter traverses.
Traverse lengths up to 12".

J. L. CLARK MANUFACTURING CO.
600 23rd AVENUE • ROCKFORD, ILLINOIS



INSULATING MACHINE IM 402

THE BEST MACHINERY FOR WIRES AND CABLES

HERE ARE OUR PRODUCTS:

- **Vertical and Horizontal Insulating Winding Machines**
  Covering wires from 38 AWG size to a 4″ diam. cable, with cotton, silk, nylon, fiberglas, paper or asbestos—for magnet wire, telephone cable, power cable, flexible cable.
- **Bunching Machines for Fine Wire**
- **Assembling Machine for up to 18 Covered Wires**
- **Hi-Speed Winding Machines**
- **Quadding and Twisting Machines**
- **Horizontal Twinners**
- **Rubber Covering Machines**
- **Cable Handling Equipment**
- **Re-Spoolers**
- **Haul-Off Capstans with Variable Drive**

POURTIER MACHINES

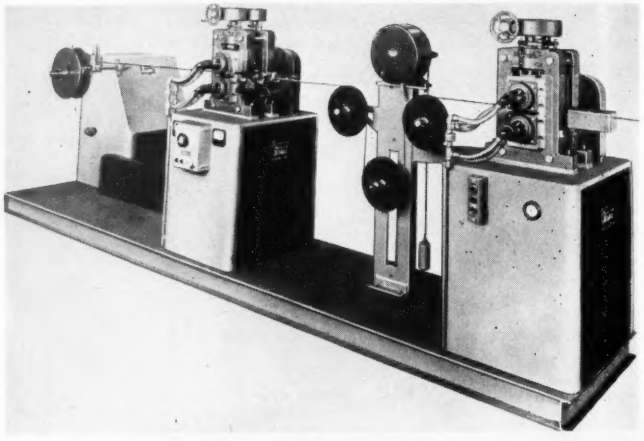
153, RUE GALLIENI, ROMAINVILLE (SEINE), FRANCE

StANAt

TWO-STAND

WIRE FLATTENING MILL

6" DIAMETER — WATER COOLED ROLLS



Illustrated Model T-400

High Speed — Low Cost — Rugged Construction

Simplicity of design makes this machine easily adaptable to short or production runs. ● Compact electrical system operates from A.C. source and provide stepless speed adjustment with automatic wire tension. ● Edging rolls are provided with quick release for easy threading.

Also available in single units or other combinations.

STANAT MANUFACTURING COMPANY

47-28 37th Street Long Island City, N. Y.

Designers and mfrs. of rolling mills, gang slitters, wire mill and special machinery

CONSULT OUR ENGINEERING DEPARTMENT REGARDING YOUR ROLLING AND SLITTING PROBLEMS

George A. Boswin

George A. Boswin, an executive of the **Hubbard Spool Company** of Garrett, Indiana, died on November 11, 1951 at the age of sixty in the St. Joseph's Hospital in Chicago.

★ ★ ★

Mr. Boswin had attend the opening of the Wire Association Convention in Chicago and, complaining of feeling ill, had gone home, from where he was taken to the hospital, where he remained until his death.

★ ★ ★

He had been with the Hubbard Spool Company for eight years as Sales Manager of the Garrett Division. Prior to that he had been with the Stevens Metals Products Company at Niles and before that with the R. B. Hayward Company in Chicago.

★ ★ ★

Mr. Boswin devoted the last twenty years of his life principally to the development and sale of cable reels and was a recognized authority on the design and construction of shipping reels. He was well-known throughout the wire industry in the United States and Canada in both of which countries he had many close friends.

★ ★ ★

Mr. Boswin was a native of Toledo, Ohio, and a graduate of the Armour Institute of Technology, but had spent the greater part of the last thirty years as a resident of Chicago. He is survived by his widow.

★ ★ ★

Electric Furnace Opens Coast Office

Electric Furnace Co., Salem, O. has appointed **Charles J. Paumier** as its Pacific Coast representative. He formerly was connected with Revere Copper & Brass Co. Mr. Paumier has opened offices in the Bank of America building, Los Angeles, California.

★ ★ ★

Miller Heads A. S. & W.'s Metallurgical Department

William R. Miller has been appointed to the post of manager of the Metallurgical Department of the **American Steel & Wire Company,** succeeding **James R. Thompson,** who retired on November 1st.

★ ★ ★

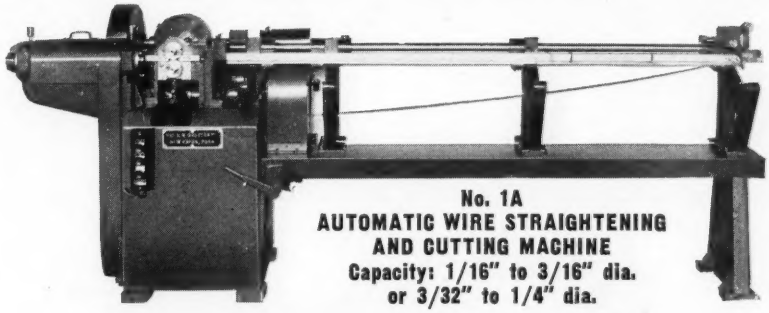
Mr. Miller is a native of Cleveland. He graduated from Fenn College in 1934 with a degree in metallurgical engineering. He came to the Wire Company in 1936 as an observer in Cuyahoga Works rod mills. Two years later he was made second assistant Works metallurgist. After holding several positions in Cuyahoga Works metallurgical departments, he was appointed division metallurgist of the wire mill in 1944. Later that year he was named Cuyahoga Works metallurgist. In 1947 he was transferred to Cleveland general offices to become assistant manager of the company's metallurgical department, a position he has held since.

★ ★ ★

Made Superintendent of McKay's Chain Plant

Thomas B. Hogan has been made general superintendent of McKees Rocks, Pa., chain manufacturing plant of **McKay Co.** He has been with the company since 1935.

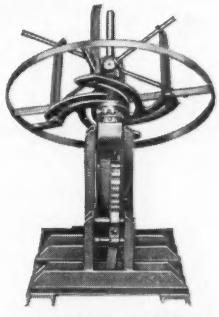
A "SHUSTER" *automatically* boosts production in wire-using plants!



No. 1A
AUTOMATIC WIRE STRAIGHTENING AND CUTTING MACHINE
Capacity: 1/16" to 3/16" dia. or 3/32" to 1/4" dia.

Wherever a Shuster is installed, production increases as high as 75 percent have been recorded. Shusters take wire from coil stock, then straighten and cut it to accurate lengths, all in a smooth, precision operation noted for the almost continuous wire travel. Once set, Shusters require little attention beyond keeping them supplied with coils.

Sizes available for .025" to 11/16" dia. wire; shapes, flat stock, tubing. Write us your requirements.



SHUSTER WIRE REELS
The counterbalancing weight does practically all the lifting, permitting one man to raise the heaviest coils of wire to the operating position.

Mfd. by **METTLER MACHINE TOOL, INC.**
132 W. Lawrence St., New Haven, Conn.
Representatives in all principal cities and in foreign countries.

SHUSTER *Automatic* Since 1866 WIRE STRAIGHTENING AND CUTTING MACHINES

Meeting on Electric Furnaces in Ferrous and Non-Ferrous Industries

The future of the electric furnace in the steel and non-ferrous metals industries was explored at a two-day joint West Penn Power-Westinghouse Electric Corporation customer meeting held recently in Cambridge Springs, Pennsylvania. Eighty-five top management men from southwestern Pennsylvania heavy industrial plants attended.

★ ★ ★

During the afternoon of the first day the members visited the nearby Westinghouse Meadville plant, manufacturer of electric furnaces, where engineers pointed out methods of construction and design features.

★ ★ ★

To give the business men a better understanding of the characteristics and advantages of the industrial electric furnace, the second day was given over to major talks about the furnace components; refractories; types of alloys used in furnaces; types of mechanical conveyors for internal and external combustion furnaces; the economics (first and operating costs); and the possible applications in the ferrous and non-ferrous metals industries.

★ ★ ★

Pennsalt to Add Chlorine Unit in Kentucky

Beginning the second major step in the development of its Calvert City, Ky., works, the **Pennsylvania Salt Manufacturing Company** has announced it will add new facilities, including an electrolytic chlorine-caustic soda unit, at an estimated cost of $8,000,000.

★ ★ ★

As the first step, Pennsalt completed a hydrofluoric acid and sulfuric acid plant in 1949 on its Tennessee River location near TVA's Kentucky Dam. These facilities have been expanded by the addition, in 1950, of a unit to produce end products from captive hydrofluoric acid and, now nearing completion, a 33 percent increase in hydrofluoric acid capacity.

★ ★ ★

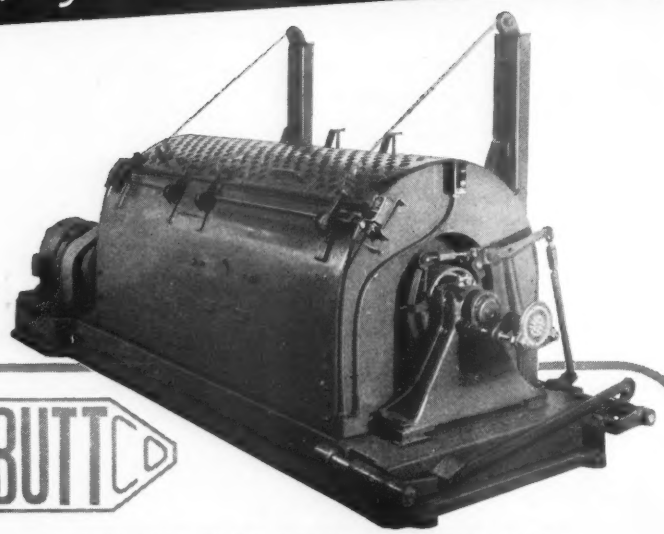
Addition of the new unit will combine at one works four basic chemicals—hydrofluoric acid, sulfuric acid, chlorine and caustic soda, the first combination of these four products in one works in the United States. Anhydrous hydrochloric acid will also be made at the new plant.

★ ★ ★

In the development of Calvert City as an integrated center of chemical industry, it was pointed out that the Air Reduction Co. is building a calcium carbide and acetylene plant in the same area. Availability of such basic chemicals in combination will probably attract further chemical production to the area. The B. F. Goodrich Chemical Co. also has announced plans to build a vinyl chloride plant on property adjacent to that of both Pennsalt and Air Reduction.

★ ★ ★

Give your Production a New Twist!



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HERE'S THE HIGH SPEED BUNCHER FOR FAST, ECONOMICAL TWISTING OF SMALL WIRES

Check these big features:

- ☐ Two twists produced at each revolution
- ☐ Accommodates standard shop reels up to 24" dia. x 12¾" O.A. width
- ☐ Double drum grooved capstans
- ☐ Quick acting electrically operated brakes
- ☐ Push button control station
- ☐ Substantial guards and safety features
- ☐ Anti-friction bearings
- ☐ Rugged construction with low center of gravity

Butt High Speed Bunchers are made in two sizes: S-31 for strands up to No. 14; S-35 for strands up to No. 8. *For further details write for Circular No. 63.*

NEW ENGLAND BUTT COMPANY

1842

WATCH FOR

OUR 1952

WIRE & WIRE PRODUCTS

DIRECTORY

A Review of Recent Wire Patents

No. 2,573,793, WIRE WINDING APPARATUS, patented November 6, 1951 by Hugh Foster Kennison, Bloomfield, N. J., assignor to Lock Joint Pipe Company, East Orange, N. J., a corporation of New Jersey.

In winding the wire from a reel onto an object, the inventor provides a device acting on the wire intermediate the drum and object to apply and maintain a constant tension to the wire leaving the drum and passing to the object even though the length of wire between the drum and the object changes during a wire-winding operation.

★ ★ ★

No. 2,573,809, PRONGED WIRE PIN, patented November 6, 1951 by Daniel I. Reiter, New York, N. Y.

A double-pointed and double-band pin is provided composed of a single length of wire.

★ ★ ★

No. 2,573,820, SHUTTLE FOR WIRE-WEAVING LOOMS, patented November 6, 1951 by Chester F. Wickwire, Cortland, N. Y., assignor to Wickwire Brothers, Inc., Cortland, N. Y., a corporation of New York.

It is claimed that this shuttle will handle longer continuous strands of weft wire than formerly and will permit the loom to be operated at higher speeds whether the fixed spool in the shuttle is full or nearly empty.

★ ★ ★

No. 2,573,821, SHUTTLE FOR WIRE-WEAVING LOOMS, patented November 6, 1951 by Chester F. Wickwire, Homer, N. Y., assignor to Wickwire Brothers, Inc., Cortland, N. Y., a corporation of New York.

The support for the flyer is removably mounted in the hub of the bobbin, so that threading operations are greatly simplified.

★ ★ ★

No. 2,574,313, WIRE COATING COMPOSITIONS, patented November 6, 1951 by Robert J. Anderson, Springfield, Mass., assignor to Monsanto Chemical Company, St. Louis, Mo., a corporation of Delaware.

This composition consists of 100 parts of a polyvinyl formal resin and from 40 to 150 parts of a soluble, fusible, heat-hardenable reaction product of 1 mol of a phenol with from 0.75 to 2 mols of formaldehyde and from 5 to 50 parts, based on 100 parts of the phenol, of a drying oil.

★ ★ ★

No. 2,574,572, CONSTRUCTION FOR CONNECTING WIRE MEMBERS TOGETHER AND METHOD OF PRODUCING AND ASSEMBLING THE SAME, patented November 13, 1951 by Richard R. Leven, New York, N. Y., assignor to The Englander Company, Inc., Chicago, Ill., a corporation of Delaware.

Wire members of frame constructions are connected, so that a portion of the smaller member is located within an offset longitudinally slotted portion of the larger member and is secured therein by inwardly bending the opposite sides of the offset portion to constrict the slot.

★ ★ ★

No. 2,575,642, PLEAT FORMER AND HOLDER, patented November 20, 1951 by August R. Sylvanus, San Francisco, Calif.

The holder is adapted for use with draperies and is constructed wholly of wire.

★ ★ ★

No. 2,575,774, APPARATUS FOR CONNECTING COIL SPRINGS, patented November 20, 1951 by Julius Spuhl, Saint Gallen, Switzerland.

This apparatus is provided for joining the end turns of helical springs to the frame of spring boxes for the manufacture of upholstered chairs and the like.

★ ★ ★

No. 2,575,785, WIRE HANDLING APPARATUS, patented November 20, 1951 by Phineas A. Beaman and John R. North, Worcester, Mass., assignors to Morgan Construction Company, Worcester, Mass., a corporation of Massachusetts.

★ ★ ★

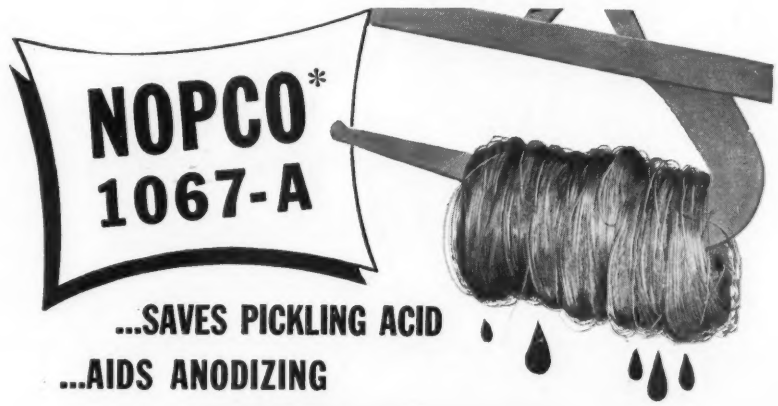
This apparatus provides a wire bundle stripper and a support for bundles as the wire is payed off therefrom.

★ ★ ★

No. 2,575,899, AUTOMATIC WIRE TYING MACHINE, patented November 20, 1951 by Williard F. Vining, Chicago, and Martin L. Rowe, Oak Park, Ill., assignors to Gerrard Steel Strapping Company, a corporation of Delaware.

In this machine wire is fed from a sup-

Complete Description and Drawings of Patents May Be Had for 50 cents, outside the United States and Canada $1.00. Address, Wire & Wire Products, 453 Main St., Stamford, Conn.



In all of these important operations—pickling, anodizing, phosphatizing—the remarkable ability of Nopco 1067-A to reduce surface tension in mineral acid solutions leads to definite economies, improvements in processing, and better final products.

PICKLING—Addition of Nopco 1067-A to the pickling bath—

(a) reduces loss of acid solution through carry-over to the rinsing tank by 30% to 40%;

(b) reduces acid contamination in operations following pickling—helping to increase die life;

(c) effects faster and more uniform penetration of oxide scale—assuring clean, *smooth* metal surfaces after pickling.

In general, 0.1% of Nopco 1067-A on the weight of the acid solution gives outstanding results.

ANODIZING—Use of Nopco 1067-A in the anodizing bath not only affords high drain-off of the acid solution, but results in "taming" of the bubbles caused by air-blast agitation. Bubbles are reduced in size and they burst gently, minimizing spray. In some instances, need for costly lead-lined exhaust fans has been eliminated.

PHOSPHATIZING—Addition of 0.1% of Nopco 1067-A to "Bonderizing" chemicals lowers surface tension substantially. This results in exceptionally even spreading which promotes excellent over-all adherence of paint or enamel to ferrous metal.

Mail the attached coupon today. We'll send you promptly full information about Nopco 1067-A —the unique wetting agent which not only assures improved products but saves money, time, and labor in all types of acid treatments.

*Reg. U. S. Pat. Off.

NOPCO CHEMICAL COMPANY
Harrison, N. J.

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Please send me full information about Nopco 1067-A

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ply but a device is provided for reversing the feed, and a loose loop of progressively increasing size is formed by reason of the reversal of the feed and accumulation of the wire. A one-way clutch is provided for engaging the wire intermediate the loop for preventing the wire in the loop from moving backwards toward the supply.

★ ★ ★

No. 2,575,911, WIRE ENAMELING DIE, patented November 20, 1951 by Robert H. Denham, Scotia, N. Y., assignor to General Electric Company, a corporation of New York.

A concentric coating or film is provided upon wire by this die. There are 11 claims.

★ ★ ★

No. 2,576,227, NONMETALLIC ARMORED ELECTRICAL SUBMARINE CABLE, patented November 27, 1951 by Loren H. Hutchins, Jr., Wakefield, Mass., assignor to Simplex Wire & Cable Co., Cambridge, Mass., a corporation of Massachusetts.

About a core of polyethylene insulation are wire strands of uniform cross-section and in a single layer at an angular lay with respect to the longitudinal axis of the cable.

★ ★ ★

No. 2,576,438, SELF-LOCKING SCREW-THREADED ELEMENT, patented November 27, 1951 by Willard C. Beach, Montville, N. J.

Slots are provided adjacent the entrance end of the element, these slots extending transversely of the axis of rotation of the threaded portion, each slot entering the threaded portion on one side of the axis and extending from the side across and beyond the axis and the slots overlapping throughout the diameter of the element.

★ ★ ★

No. 2,576,441, DOORKNOB STRUCTURE, patented November 27, 1951 by Samuel Bloomfield, Wichita, Kans., assignor to C. Earl Hovey, Kansas City, Mo., trustee.

This device is an all-wire one for preventing rattle of door knobs.

★ ★ ★

No. 2,576,568, COIL-WINDING MACHINE, patented November 27, 1951 by James S. Burge and Richard M. Goodwin, Anderson, and Hilton J. McKee, Middletown, Ind., assignors to General Motors Corporation, Detroit, Mich., a corporation of Delaware.

More specifically, the invention relates to the power-operated mechanism for rotating a form upon which wire is wound to make an electrical coil and for guiding the wire from the form from a wire supply.

★ ★ ★

No. 2,576,729, SPRING LINER ASSEMBLY, patented November 27, 1951 by Newton E. Shockey, Detroit, Mich., assignor to Van Dresser Specialty Corporation, Van Dyke, Mich., a corporation of Michigan.

An upholstery spring cover is provided adapted to overlie a cushion spring assembly.

★ ★ ★

Plastics Exposition to be Held in Spring

The Fifth National Plastics Exposition, sponsored by **The Society of the Plastics Industry, Inc.,** will take place next March 11-14 in Convention Hall, Philadelphia, Pa.

★ ★ ★

The Fabrication of Copper Wire

(*Continued from page* 47)

what is termed Continuous Strand Annealing. The method and apparatus to carry this out have now been fairly well developed, but this type of annealing is not yet widely used.

★ ★ ★

There are two types of these machines: one in which an electric current is passed through the hard wire; the resistance set up causes the wire to be heated and become soft. The other type is one in which a number of strands of hard copper wire are carried continuously through a gas-fired furnace. In both types of furnaces a neutral gas atmosphere is maintained to prevent oxidation. Many difficulties were encountered in developing these two types of continuous strand annealing furnaces, but according to

PREPARED *with quality soaps for every wire drawing need.* No matter what your particular requirement may be, you can select the soap to fit from Swift's complete line. Efficient lubrication, minimum dusting and uniform quality are characteristics of Swift's wire drawing soaps.

PREPARED *to apply our knowledge of soap to your lubrication problems.*

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Snap Heavy Duty Wire Drawing Powder No. 282
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Plus other special formulations to meet your specifications. See your local telephone directory for address of the Swift office nearest you.

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latest reports, these have now largely been overcome.

★ ★ ★

Nearly all of the manufacturers of annealing furnaces furnished photographs, lantern slides, catalogs, and descriptive literature of their furnaces, and as in the case of other equipment, only a few can be used.

★ ★ ★

Fig. 23 illustrates a General Electric bell type electric annealing furnace.

★ ★ ★

A Kenworthy water quench single chamber rotating type furnace is shown in Fig. 24.

★ ★ ★

The Electric Furnace Company's direct gas-fired semi-continuous annealing furnace is shown in Fig. 25.

★ ★ ★

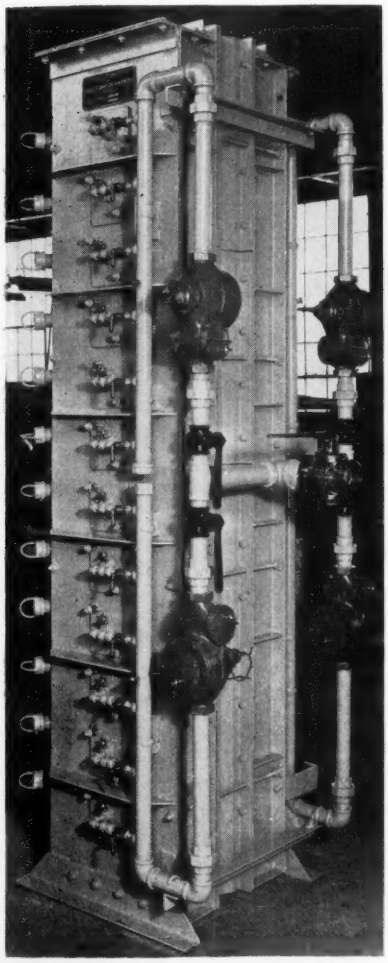

Fig. 27—The Selas Corporation Gas-Fired Strand Annealing Furnace.

Fig. 26 shows Syncro Machine Company's resistance annealer with the heat exchanger mounted on side.

★ ★ ★

The Selas Corporation's gas-fired strand annealing furnaces is shown in Fig. 27.

★ ★ ★

Lubrication

As is the case with most mechanical processes, lubrication is a very important item in copper wire drawing. Large quantities of lubricant, usually an emulsion of soap and fat in water, are required to provide proper cooling of the wire and the dies. In modern mills each group of drawing machines has its separate recirculating lubricating system. The fat content of each of these systems varies from about 7% in the heavy machines, to 5 to 6% in the intermediate and down to about 2.5% in the fine wire machines. In these systems, means are provided for settling the fine copper and copper oxides particles before the solution is returned to the wire drawing machines. The better these particles are removed the better the lubrication.

★ ★ ★

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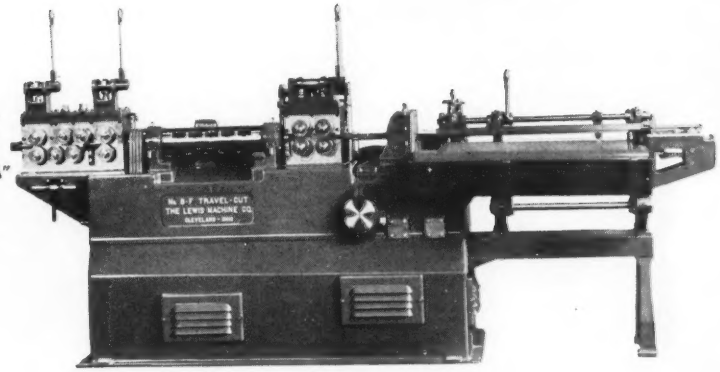

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also important. Very hard water will cause the precipitation of the soap which in turn will affect the stability of the fatty emulsion making up the lubricant. If the dies become clogged with lubricant, surface particles from the wire will be retained in the dies causing them to wear out rapidly. Excess acidity in the water is also detrimental and a pH of about 8.5 has been found to be most satisfactory. Before the lubricant is returned to the machines, it must be cooled. In modern mills air heat exchangers are used to remove the excess heat.

★ ★ ★

More and more attention is being given in modern wire mills to the question of residual lubricant on wire, especially when it is sold in the bare annealed condition. It is true that staining is largely due to improper atmospheric conditions in the bright annealing furnaces, but if the wire, when it goes into the furnace, has excessive adhered lubricant, it will come out stained even if the atmosphere in the furnace is the proper one. In modern mills care is taken to use the right kind of lubricants and that it is removed as completely as possible from the finished wire.

Defects in Wire

It is trite to say that a chain is no stronger than its weakest link. Likewise, it is often said that if any one portion of the process used in wire fabrication is faulty, then it is impossible to produce good quality wire. This last statement may be somewhat of an exaggeration, because in some cases it is possible to correct the defects developed in an earlier stage of fabrication, but in the main, the statement is true.

★ ★ ★

A common defect in copper wire is that of slivers. These may be caused by improperly cast wire bars and/or by improper hot rolling. Horizontally cast wire bars having cold shuts, rough edges and bad sets, will make slivery rod and wire. Scalping the set surface of a wire bar removes some of the defects. Likewise, shaving removes the surface of the hot-rolled rod and thus slivers and other surface defects, particles of broken off copper and/or refractory material rolled into the rod, that would result in poor quality wire and cause excessive breakage on drawing.

★ ★ ★

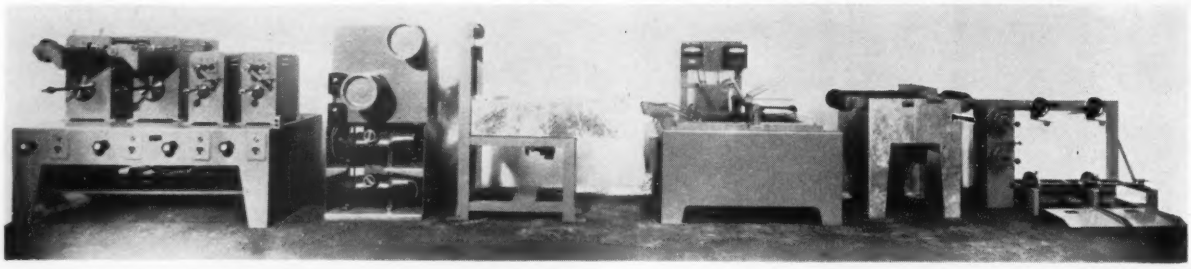
During wire drawing, defects and breakages may be caused by excessive speeds, wear on capstans, too much tension, improperly designed dies, poor lubrication, and a number of other minor mal-practices.

★ ★ ★

As mentioned before, "cuppy" rod and wire is generally due to dies having too acute angles and too short a bearing surface. Improperly designed dies of this sort cause the rod or wire to be unevenly worked throughout the cross section, that is, the outer portion is worked more than the inner portion and as a result the core will develop internal fractures.

★ ★ ★

A defect known as "crow's foot" is nowadays quite uncommon due largely to better casting practice at the refineries and the introduction of scalping of wire bars and shav-



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A water bath.

A capstan unit and a take-up, arranged for 2 large spools for large size wires and 2 small spools for small size wires, each spool spindle driven by a torque motor.

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ing of rod. Vertical cast tough pitch copper wire bars and oxygen-free copper wire bars having no set surface are free from the imperfections which may result in wire having "crow's foot" defects. These two types of bars need not be scalped and if the hot-rolling is properly carried out, the rod need not be shaved in order to produce high quality wire bars.

Specifications

In the United States it is common practice of refineries and wire mills to manufacture and sell their products in accordance with the specifications of the American Society for Testing Materials. Table V gives the A.S.T.M. Specifications applicable.

TABLE V

American Society for Testing Materials Specifications Commonly Used in the Manufacture and Sale of Copper Wire of Circular Cross Section

Designation	Specifications for
B-1-49	Copper wire, hard drawn
B-2-49	Copper wire, medium hard drawn
B-3-45	Copper wire, soft or annealed
B-4-42	Lake copper wire bars, cakes, slabs, billets, ingots and ingot bars.
B-5-43	Electrolytic copper wire bars, cakes, slabs, billets, ingots and ingot bars.
B-49-50	Copper rods, hot-rolled, for electrical purposes.
B-115-43	Electrolytic cathode copper
B-170-47	Oxygen-free electrolytic copper wire bars, billets and cakes.
B-224-48 T	Classification of coppers (tentative)

★ ★ ★

Conclusion

In concluding this lecture, may I say a few words about the thoughts which those connected with the copper wire industry are having with regard to improvements in design of equipment and of operations. I have here confined my remarks to the fabrication of round wire, or wire having circular cross section.

★ ★ ★

Speed of wire drawing remains an interesting subject of discussion. In certain mills speeds have been reduced, it having been found that while it was possible to draw the wire at very high speeds over considerable lengths of time, breakages became excessive and the net production decreased. Likewise, the idea of heavier unit reductions at each die or, expressed in another way, a decrease in the number of dies to produce a certain size of wire, has taken a reverse trend for the same reason—excessive breakage. In one mill it was found that by increasing the number of draws, less breakage occurred, resulting in an increase in the net production. This tendency is by no means universal. One mill which already is drawing at speeds in excess of 10,000 ft. per minute, expects to continue these high speeds by taking the utmost care at each stage of fabrication. Most careful attention is given to keeping wire drawing machines in the highest state of efficiency. Dies of proper design are at all times kept in perfect condition. The best type of lubrication is used for each operation.

★ ★ ★

Where large quantities of wire of one size are involved, such concerns as Western Electric have clearly demonstrated the economy in drawing wire continuously to produce spools weighing up to 4000 pounds. True, this involves many new handling problems, but when these are solved, there is no question that unit costs are reduced.

★ ★ ★

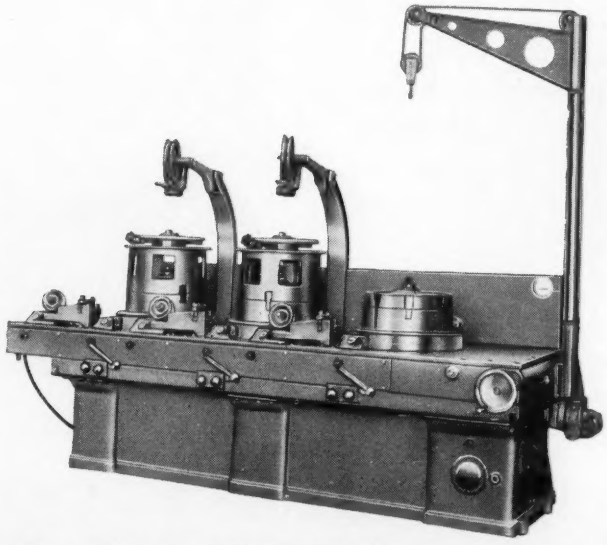
EW

Wire Drawing Machines, working on the dry or wet method (soap powder or by immersion) for iron, steel, copper, aluminum and other metal wires.

Metal Wire Cloth Weaving Looms (fly & mosquito nets, sieves, plastering work).

Automatic Straightening and Cutting Machines.

Machines for producing: Wire nails and wire tacks, rivets, iron & wood screws, small nuts, welded and non-welded chains, knotted chains, barbed wire, wire pins, safety pins, hair clips, spokes and nipples for bicycles, etc.



EMILIO WARTENWEILER

MILANO (Italy) Via G. B. Pergolesi, 18

Going back to the subject of dies, it is interesting to note that wire drawing machines have been built in which it is possible to rotate the die. It is reported that the theories on which this was done have been confirmed in practice; that is, the power requirements were reduced and the die performance improved.

★ ★ ★

Forward-looking wire fabricators in conjunction with important die manufacturers are continuing to study die lubrication and die design. The quality of the tungsten carbide has been improved resulting in longer die life. However, it is most interesting to note that despite the very great increase in drawing speeds during the last 10 to 12 years, the tonnage of wire per mill of actual die wear has actually decreased with the increase in drawing speeds during the last 10 to 12 years, the tonnage of wire per mill of actual die wear has actually decreased with the increase in drawing speeds. But most wire mills consider the die life as an expendable, which is more than made up by an increase in production. Nevertheless, there is an economic balance at each mill which can not be too greatly disturbed.

★ ★ ★

The idea of doing things continuously intrigues people in the wire industry as it does in other industries. Wherever possible the aim always is to reduce the amount of handling and thus reduce the number of men required. Continuous rod rolling is advantageous where large tonnages of the same size are to be rolled. Continuous wire drawing, by which is meant no looping by hand, is likewise a disideratum for the same reason.

★ ★ ★

Continuous strand annealing is desirable for many reasons. Finally, if it were possible to combine a number of continuous operations in one grand continuous operation, . we should perhaps be reaching the millenium.

★ ★ ★

I would like also to mention the ever-recurring idea of applying back-pull to wire drawing. The more scientific term is "reactive wire drawing." The theorists on solid ground can prove mathematically that economies would result if this principle were applied. But as far as I know, despite numerous attempts to utilize the principle in a practical way, the claims made by its proponents have not been substantiated. Therefore, we can safely say that this method of wire drawing is still very much in the development stage.

★ ★ ★

In closing may I again say that I feel highly honored in having been asked to deliver this lecture. As a reward for your indulgence, an interesting and informative motion picture entitled "A MIRACLE FOR MRS. SMITH" will now be shown. We are deeply indebted to the Western Electric Company for their courtesy in making this film available to us.

★ ★ ★

I must not fail to mention that were it not for the assistance given me by the engineers and metallurgists of the following concerns, it would have been very difficult to

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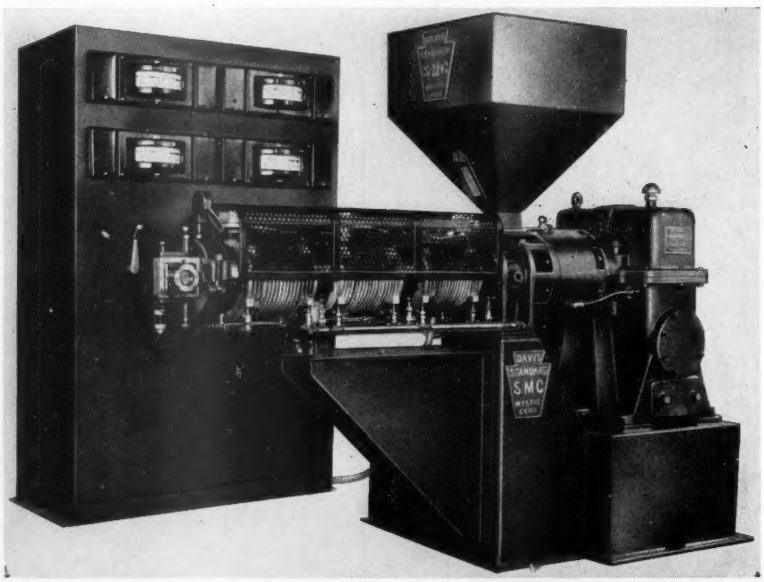

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Waterbury-Farrel Foundry and Machine Co.
Western Electric Company
Westinghouse Electric Corporation.

Special thanks are due:

Mr. Herbert J. Miller, Research and Engineering Manager, Refinery and Wire Mills Division of British Insulated Callender's Cables, Ltd., Prescot, England.

Mr. Stanislaw Skowronski of International Smelting and Refining Co., Perth Amboy, N. J.

and

Mr. J. E. Wiltrakis of the Western Electric Co., Kearney, N. J.

LADIES and GENTLEMEN, MEMBERS OF THE WIRE ASSOCIATION, and GUESTS, I THANK YOU.

★ ★ ★

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A Annealing furnaces and methods.
B Wire Bar Production and machinery therefor.
C Controls, Tests.
D Dies, Tungsten Carbide and Diamond, their manufacture and use, repair, etc.
F Flow charts, plant organization, materials handling.
H History of wire drawing, dies, lubricants, etc.
L Lubrication.
M Machinery for wire drawing, descriptions.
P Plant descriptions.
R Rod production.
T Theoretical and scientific investigations related to copper wire manufacture.

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★ ★ ★

New Wire Directory Published in England

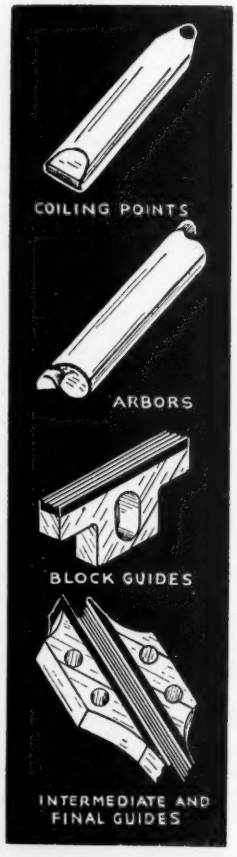
Neil Lindsay, 48 Queen St., Wolverhampton, England, has issued the first edition of a new directory entitled **"The Wire Reference Year Book and Directory"**. It sells for £1.10.0 net.

★ ★ ★

In the directory the publisher has 1200 headings and 6000 listings of product manufacturers, a spring glossary, a report on industrial spring and wire drawing research, a chapter on wire furnaces and ovens, and considerable matter on wire rope.

★ ★ ★

The first issue was published in conjunction with the Festival of Britain that was held in England from May to September, 1951.



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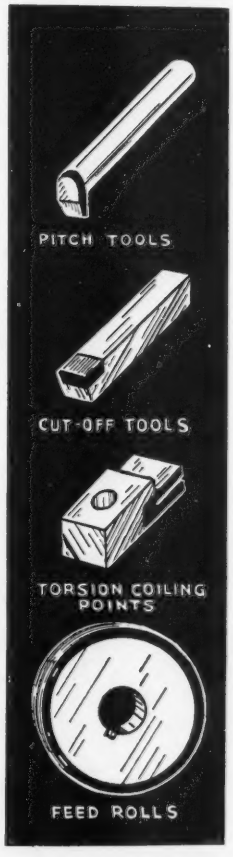


Fence Machine Bulletin

An interesting bulletin describing their new, improved "wrapped stay" field and poultry fence machines has been issued by the **Interlocking Fence Company**, Morton, Illinois.

★ ★ ★

The several models are illustrated and specifications and features are listed. The looms embodying the popular hinge-joint, are said to be the fastest, most efficient and heaviest looms built.

★ ★ ★

Copies of this bulletin will be sent to our readers upon written request direct to the manufacturer.

New Process for Tinning Copper Wire Announced

A high-speed alkaline process for electrotinning copper wire developed by the **Metal and Thermit Corporation,** with equipment for it designed and built by the **Syncro Machine Company**, is now available. The latter company has built a two-strand unit that can be demonstrated, for which better coatings and important savings of tin are claimed to be possible. One machine in tests shows the following results on 14 gage wire, operating an 8-strand machine at 600 feet per minute, 16 hours per day for 250 days in the year: Tin savings, over the hot-dip method, will run 8.6 lbs. per ton of wire; the machine will tin 5,724 tons per year and save, at the current price of tin, $44,889.00 per machine. Savings on other gages have also been worked out in tests.

★ ★ ★

Due to the copper wire shortage, demonstrations must be made on wire furnished by the concern wanting to see the process in actual operation. Appointments can be made by writing to either Metal and Thermit Corporation, 100 East 42nd St., New York 17, N. Y. or Syncro Machine Company, 611 Sayre Ave., Perth Amboy, N. J. Requests for demonstrations should state the quantity and gage of the wire that will be furnished for tinning.

★ ★ ★

New Edition of "The Making, Shaping and Treating of Steel"

Scientific advances in the steel industry during the last ten crowded, eventful years are covered fully for the first time in one book in the new edition of the steel maker's standard reference, U. S. Steel's "The Making, Shaping and Treating of Steel."

★ ★ ★

In addition to new information, descriptions of standard processes have been revised or rewritten to bring them up-to-date. The new edition, the sixth, will be ready for initial distribution December 1.

★ ★ ★

Experts and authorities in each steelmaking field were mobilized to prepare the new book. It is presented in 38 chapters, subdivided into sections. Each chapter and section is made as nearly independent of the others as possible. With more than 23,000 listings, the index of the sixth edition is cross-referenced and covers 148 pages of the 1,435-page book. An 83 page section is devoted to the manufacture and processing of rod, wire and wire products.

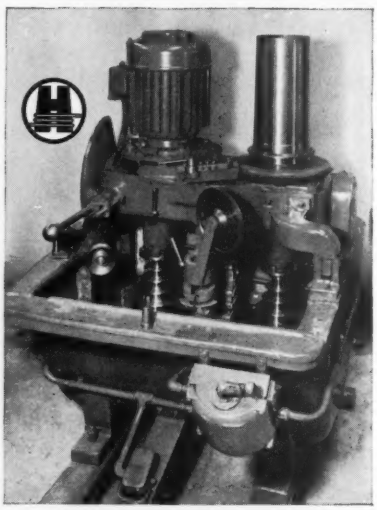
★ ★ ★

The edition is published on a non-profit basis. It is priced at $7.50. Orders for the book will be received by the Treasurer, **United States Steel Company,** 525 William Penn Place, Pittsburgh 30, Pennsylvania.

★ ★ ★

HERBORN

WIRE DRAWING MACHINERY



HERBORN High-Efficiency 11-Die Wire Drawing Machine, Model TF IIIa

for the drawing of iron wires, starting size .0591", finishing .0236" or less, and of steel wires from .0473" to .0197" or less; for phosphor bronze and other hard wires from .0473". 10 hp. motor with change-speed gearbox.

FOR all metals, from wire rod to finest fractional dimensions with single and multiple draw.

Herborn High Efficiency Multiple Wire Drawing Machines are unsurpassed in efficiency and economy.

Continuous electric patenting, tempering and annealing equipment for wire, rod and strip, tinning and galvanizing installations.

The complete range of types, sizes and capacities, covered by Herborn Wire Drawing Machinery, provides the most efficient solution for your wire drawing operations.

Particulars and prices on request.

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Sprague Opens Office in Dayton, Ohio

Sprague Electric Co. announces the opening of an application engineering office at 3 East Second Street, Dayton, Ohio. The new office is intended to provide more effective contact with mid-western Government research and development laboratories, according to **Julian K. Sprague**, vice-president.

★ ★ ★

William M. Lana, former Air Force engineering officer, will head the new office. Mr. Lana has been a member of the Sprague application engineering staff at the company's North Adams headquarters. He is a graduate of the University of California Engineering School and has had a wide and varied industrial experience in addition to his military service.

★ ★ ★

New Roller Chain Catalog

Baldwin-Rex Double Pitch Roller Chains are pictured and described in detail in a new bulletin released by Chain Belt Company of Milwaukee.

★ ★ ★

The bulletin describes how these chains can often effect both cost and weight reductions in drives and conveyors. Charts, photos, diagrams, and tables show in detail all Baldwin-Rex Double Pitch Roller Chains —both drive and conveyor types— and the standard attachments available. There is also a description of double pitch chain sprockets.

★ ★ ★

For a copy, write **Chain Belt Company**, 1600 West Bruce Street, Dept. PR, Milwaukee 4, Wisconsin and ask for Bulletin 51-2.

★ ★ ★

New Metallizing Handbook

A new metallizing handbook has recently been published by **Metallizing Engineering Co., Inc.** 38-14 30th St. of Long Island City 1, N. Y. The 250-page text, a completely new work, is profusely illustrated with photographs, diagrams and charts. It provides a comprehensive coverage of the technical as well as practical aspects of the process. Various methods of surface preparation and the application of metallized coatings for machine element work, for corrosion work, and for many special production jobs, are thoroughly detailed along with valuable supplementary information.

★ ★ ★

According to Metco, this comprehensive new handbook is the result of almost 20 years of experience in the design, manufacture and use of metallizing equipment. Price of the cloth-bound edition has been set at $3.00 per copy, postpaid in the United States and Great Britain only.

★ ★ ★

New Vari-Speed Drive Announced by Reeves

A new size Vari-Speed Motodrive is announced by **Reeves Pulley Company**, Columbus, Indiana, manufacturers of variable speed control equipment.

★ ★ ★

Designated as Model No. 8000, the new unit has a capacity of 25 HP and is available in all speed ranges from 2:1 to 6:1. Like other REEVES Vari-Speed Motodrives, the No. 8000 is a complete, self-contained variable speed power plant. It combines in a single space-saving unit the REEVES speed-varying mechanism, the user's choice of any standard constant speed motor, and a built-in helical gear reducer, when low output speeds are required.

★ ★ ★

The new No. 8000 model is offered in horizontal and vertical designs.

USERS OF THESE CABLE REEL BORERS REPORT

PRODUCTION INCREASES UP TO 500%

In one single operation, this remarkable machine bores ALL the holes in a wooden cable reel head. In addition, it has the exclusive Root Patented Hydraulic Feed which provides a stepless range of feed from 2 to 29 strokes per minute. Operator is not handicapped by limited feed rate. This increases production tremendously. Can also be used for other boring purposes. Made in three sizes. *Write for Bulletin No. 132.*

"Can honestly say this machine alone has increased our production over 200%! Our profits increased 100%!"
V. Fairhurst, Mgr. New England Reel and Lumber Co.

ROOT
HYDRAULIC FEED
REEL BORER

Root Reel Borer being used by New England Reel & Lumber Co.

B. M. ROOT CO **YORK, PA.**

Handwheel control is standard, but electrical or completely automatic hydraulic controls are also available. A tachometer, calibrated to the user's specifications, may also be attached.

★ ★ ★

IPCO Safety Scoreboard

Industrial Products Company announces a new safety record sign. Designed to act as a constant reminder of days worked without a lost time injury, conveys the thought that responsibility rests with each employee. Keeps up daily interest and makes for a well-informed organization.

★ ★ ★

The IPCO Safety Scoreboard is 20″ wide by 30″ high, large enough to be seen at a distance. Attractively finished with green background and white letters. Has two blackboard panels on which it may be kept up-to-date with chalk markings.

★ ★ ★

Manufactured of 20-gauge metal and finished in baked deluxe. For indoor or outdoor use.

★ ★ ★

Full information may be obtained by writing to Industrial Products Company, 3047 N. Fourth St., Philadelphia 33, Pa.

★ ★ ★

Announcement of New Publication

A new Supplement to Screw-Thread Standards for Federal Services, the 1950 supplement to National Bureau of Standards Handbook H28 (1944), vi, 113 pages, with 17 tables and 17 figures, has been published.

★ ★ ★

Replacing and augmenting the 1949 Supplement to Handbook H24, this supplement makes effective a number of changes in American screw thread standards adopted since publication of the 1944 edition of the Handbook. Approval of these revised standards by the Secretaries of Defense and Commerce and the Secretaries of the Departments of the Army, Navy and Air Force makes them available for application to new designs and for acceptance of bolts, screws, nuts, and other threaded products.

★ ★ ★

On November 18, 1948, representatives of government and industry of Canada, the United Kingdom, and the United States signed the Declaration of Accord with respect to the Unification of Screw Threads. The Unified standards for thread form, for the coarse-thread series in sizes from ¼ inch to 4 inches, inclusive, and for the fine-thread series in sizes from ¼ inch to 1½ inches, inclusive, as agreed upon at the time the Declaration of Accord was signed, appear in this supplement. In addition, it contains the subsequently agreed upon unified special threads and American National diameter-pitch combinations not yet recognized as unified standards, but for which allowances and tolerances have been formulated in accordance with the principles of unified threads. Tables of tolerances, allowances, and other thread data for threads of special diameters, pitches, and lengths of engagement are also given.

★ ★ ★

Copies are 50¢ each and may be ordered from the Government Printing Office, Washington 25, D. C.

★ ★ ★

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in
Wire-Straightening
and Wire-Cutting!
Diameter Range 1/16" to .005"
Our motto...Precision
Wire men everywhere concede that nobody in the world can match our precision straightening and cutting. This reputation springs from almost two decades of flawless workmanship for the automobile, aircraft, radio, television, communications, toy and textile industries.
Length tolerances in the ten thousandths of an inch are routine here. Wire ends show no burrs. Every day, tons of soft and hard wire are cut anywhere from fractions of inches up to 20 feet.
Don't hesitate to bring your wire straightening and cutting problems to Pittsburgh Cut Wire Company.
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All Types of Wire . . .
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Small Metal Orders

Substantial raising of the quantities of steel, copper and aluminum for which small manufacturers of Class "B" products need not apply to the National Production Authority, but for which they may self-certify their orders for second quarter 1952 delivery, has been announced by the U. S. Department of Commerce.

★ ★ ★

Direction 1 to CMP Regulation 1 has been amended to permit such manufacturers to self-certify their orders for controlled materials if their total requirements during the quarter for each of the metals shown below will not exceed the following amounts:

Carbon steel	**30 tons**
Alloy steel	**8 tons**
Stainless steel	**1,500 lbs.**
Copper, copper-base alloy	**3,000 lbs.**
Aluminum	**2,000 lbs.**

★ ★ ★

The use of an amount of controlled materials in excess of any of the foregoing specified items, automatically removes the consumer from the special class of small users and requires the filing of a CMP 4-B application form.

★ ★ ★

Until April 1, the following are the limits for which self certification is permitted:

Carbon steel	**5 tons**
Alloy steel	**½ ton**
Stainless steel	**None**
Copper, copper-base alloy	**500 lbs.**
Aluminum	**500 lbs.**

★ ★ ★

All manufacturers of Class "B" products, whether or not they require additional quantities of controlled materials, must file applications for second quarter 1952 allotments, except those who filed for and received fourth quarter 1951 or first quarter 1952 allotments and advance allotments for subsequent quarter from NPA field offices, and those whose requirements fall within the new self-certification limits.

★ ★ ★

Manufacturers who have not had a copy of the newly revised "Official CMP Class B Products List", dated November 15, 1951 may obtain it from the New York Regional Office of the U. S. Department of Commerce at 2 West 43rd Street, or at any of the district offices of N.P.A.

★ ★ ★

G.E.'s Waterford Plant Due for Further Expansion

An expansion program costing in excess of five million dollars to increase greatly the production capacity of the **General Electric** silicone plant in Waterford, N. Y., has been announced by **Robert L. Gibson,** general manager of the Company's Chemical Division. The Waterford plant, located on a 65-acre site, is now producing silicone fluids, greases, rubbers, resins, and water repellents. The contract for the new building program has been awarded to United Engineers and Constructors of Philadelphia, who erected the original plant in 1947.

★ ★ ★

The phenomenal growth of the G-E silicone business during the past 5 years is attributed to the numerous applications for which silicones have been successfully formulated. Originaly conceived as a superior insulating material for electrical apparatus, silicones have proved advantageous in many fields entirely separate from the electric industry. ★ ★ ★

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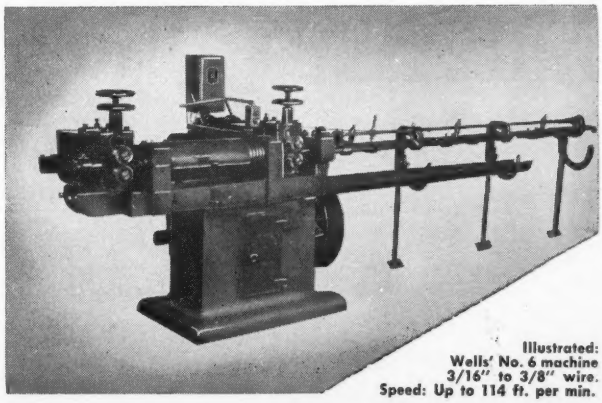
STAIGHTENERS AND CUTTERS

ARE MACHINES YOU CAN DEPEND UPON FOR STEADY RELIABLE YEAR IN - YEAR OUT CONTINUOUS SERVICE.

Let's look at the record! One WELLS user says he has been cutting ⅜" hot rolled rods for 9 years, 24 hours a day. Has two other makes, but his WELLS machines have given no trouble at all and are standing up well in this gruelling, tough service. Are operating at 120 ft. per min., cutting to tolerances of ⅛". This is only one of many instances of outstanding WELLS performance.



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Wells' No. 6 machine
3/16" to 3/8" wire.
Speed: Up to 114 ft. per min.

What WELLS machaines are doing for others they will do for you.

WELLS machines are made in a range of sizes to handle 1/16" to ⅝" wire and rods.

Every WELLS machine is backed by 57 years of constant effort to produce better and more efficient equipment. They are rugged, dependable, accurate and *low in cost.*

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Frank L. Wells Company

5821 FIFTH AVENUE

KENOSHA **WISCONSIN**

Builders of Fine Wire Making Machinery

Wire Association Discussions Monday P.M. Session

(*Continued from page* 51)

Again, gentlemen, it is a pleasure to welcome each of you here. Thank you. (Applause)

Chairman Roth: Before we begin our program I should like to make a short announcement. In order to be a successful program we must have your questions from the floor and the answers from the speakers. Please understand that your name and the name of your company will not be mentioned in Wire and Wire Products. You will be referred to as a member. Your name will not be mentioned when the proceedings are printed; therefore, do not hesitate to get up and ask questions.

To begin today's meeting it is a pleasure to present to you our first speaker, **Major Howard F. Cleary,** Signal Corps of the United States Army, Philadelphia, Contracting Officer, Wire and Cable Section, Procurement Agency. Major Cleary. (Applause)

(Major Howard F. Cleary presented his paper on "Communications Wire Program of the Signal Corps.)

Chairman Roth: Our next speaker on this afternoon's program will be James E. Flood, Chemical Engineer, Plastic Wire and Cable Corporation, Jewett City, Connecticut.

Mr. James E. Flood: Gentlemen and Members of The Wire Association: I previously wanted to talk on hazards encountered in the extrusion of nylon, but shortly after I started to write the talk we encountered so many hazards we finally decided it was not the thing to talk about. I am going to talk today about composite insulation wire construction, employing polyethylene and nylon.

(Mr. Flood read his paper.)

Chairman Roth: Does anybody have any questions he would like to ask Mr. Flood?

A Member: The speaker mentioned something about nylon-polyethylene signal cord being exposed to the tropical sun. Can you tell me what types of nylon have been used for such purpose?

Mr. Flood: I cannot tell you exactly what kind, but The DuPont Company will be glad to tell you what types to use.

Chariman Roth: Any other questions?

A Member: How does nylon compare with the polyethylene for mechanical protection, as well as protection against oils and such other deleterious substances?

Mr. Flood: Nylon primarily is used to protect the polyethylene from coming in contact with the oils thereby, from some sort of absorption which we do not understand, the electrical properties are impaired. Apparently oil in certain types of compounds used in hydraulic fluid doesn't affect nylon. It does not run through it. For example, here is an RG-22 co-axial cable, on which a wall of nylon has been coated over to be used in the section of the plane where it might come in contact with hydraulic fluids. There is a whole series of RG-59-U's, for instance.

A Member: Maybe I do not make myself clear. I was comparing nylon with neoprene.

Mr. Flood: I believe in this particular case the phosphate esters have a plasticising effect on neoprene and it would not be as satisfactory as nylon as a protective barrier over, for instance, the co-axial cable.

A Member: Abrasively how do they compare?

Mr. Flood: I do not know how to compare them abrasively. I think possibly neoprene used in a much heavier wall would have abrasion qualities superior to that of nylon.

A Member: What is the top surface temperature of nylon?

Mr. Flood: That is a bad question. We extruded it at about 500 degrees Fahrenheit, but I don't know how much lower than that you can subject it to continuously. I refer you to the DuPont Company. They may have the answer.

A Member: Have you had any experiments of exposure of nylon to ultra violet and have you gotten any results?

Mr. Flood: No, we have not. The only exposure to ultra violet that we have made is outdoor weathering.

A Member: How long did you expose it?

Mr. Flood: We have had some samples up for three years and others have been up for six. For the results of the test if you will contact the Technical Service Department at Arlington, the DuPont Company, they will be glad to tell you.

A Member: What government specification calls for a protective sheet of ny-

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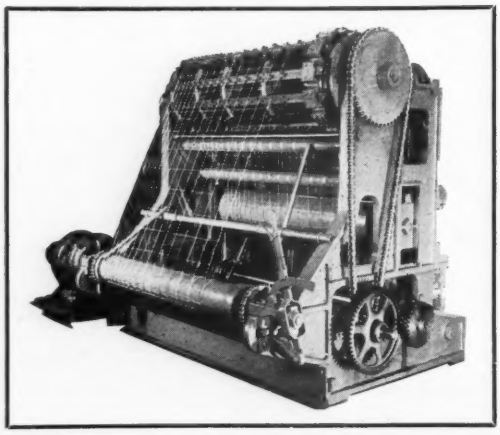

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lon over RGU cables?

Mr. Flood: No government specification that I know of calls for a protective sheet of nylon, but they are, however, buying nylon over RG-22-G, RG-59-U, and RG-8-U, and we have supplied considerable of it.

A Member: I believe you mentioned that you originally had thought about saying something about the troubles in protecting your plant against the hazards in the use of nylon. Would you like to say something more about it?

Mr. Flood: Shortly after I started to write the paper on hazards, we encountered so many that I finally gave up the idea. I am happy to relate, though, that since that time we have overcome our difficulties. That is another story.

A Member: Would you mind mentioning a few of those hazards and a quick idea of how you got out of them?

Mr. Flood: One of the worst hazards in the extrusion of nylon is that too much moisture in the granules causes frothing. Another is the extrusion of nylon at too high worm speeds. It whips it up and causes frothing. Probably the worst hazard is the extrusion of nylon at too high a temperature and holding it at too high a temperature in the extruder for too long a period of time, so that the nylon oxidizes and gives you difficulty in passing your cold bend test.

A Member: Do you find that a difference in the color of the nylon is a good indication of subjection to too high temperature, that is, can you determine before they are too high, before you put them into the cold box?

Mr. Flood: No. We at first thought that was the case, but the copper steroid used as a stabilizer changes to so many different colors we finally decided that was not it. So when you use a commercial form of nylon, say, type 3003, which is clear, unless you really burn it up until it becomes a dark brown, which takes a relatively high temperature, there will be no color indication that we could find that will indicate failure.

A Member: Do you ever find a copper stearate precipitating as flakes on your screens?

Mr. Flood: To be sure. Sometimes the flake is almost one sixty-fourth of an inch thick on your worm and breaker plate and screens.

A Member: Is there any cure for that?

Mr. Flood: I do not know of any cure. It does not seem to bother us too much. We have tried everything—stainless steel, worms, screens, breaker plates——and it still precipitated. I think there is so much excess in there, it really does not make a lot of difference.

A Member: Did you have the problem of cleaning your machine after you had used it over a period?

Mr. Flood: Yes, in the early stages we used to pull out the worm and screen and burn off the nylon, but now at the end of the shut-down on Saturday night we simply turn off the heater, turn the air on and blow it down to a temperature below the oxidizing point of nylon, and let the worm extrude all that is in there; then we shut it off. Sunday night we start up and just turn the heater on again.

A Member: You don't use the machine for any other use but nylon?

Mr. Flood: Absolutely not. You cannot use it for anything else without running into trouble, we have found.

A Member: You might mention that these gentlemen can obtain a paper from the Bureau of Standards: "Degradation of Nylon" by Gordon Klein and two or three other men. It is quite comprehensive, and if they really want to know what happens chemically, I advise their sending for it. I believe it costs 15 cents.

Chairman Roth: Gentlemen, any other questions? You are invited to step up here and look at these samples after the meeting. (Applause)

Our next speaker on the program will be Dr. Bruce W. Gonser, from Battelle Memorial Institute, Columbus, Ohio, who will deliver a paper on "High-Strength Copper-Silver, Copper-Iron, and Copper-Iron-Chromium Wire." Dr. Gonser. (Applause)

(Dr. Bruce W. Gonser presented his paper.)

Chairman Roth: Have any of you gentlemen any questions?

A Member: I should like to ask the doctor whether any thought was given to further experimentation with the cadmium alloys. You know that the American Brass Company started out many years ago and developed quite a range of those alloys. It seems to me that would be a fertile field.

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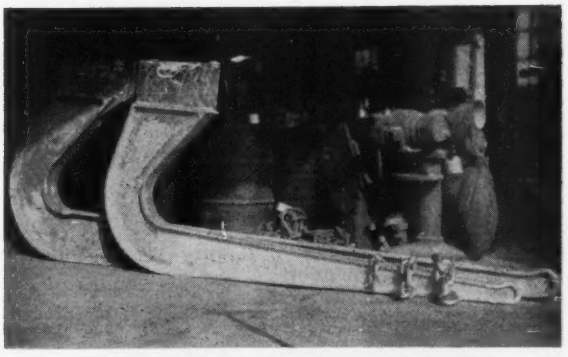

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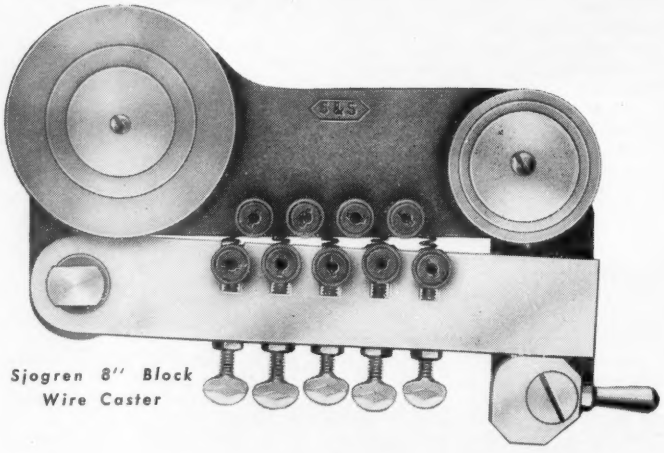

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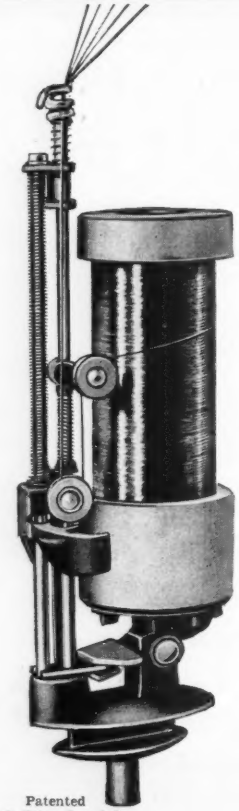

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Dr. Gonser: There are a couple of reasons for not doing any more work with the cadmium alloys. While cadmium did not hurt conductivity too much, we did not get the high strength we got with the other materials, and the cadmium supply position is not good, as you know. There is much more demand for all the cadmium we can produce than there is supply and there is no chance of getting more. Silver is not particularly tight. Iron is not either; therefore, they seem like the most logical metals to use. If there was not this tight situation, it certainly would be.

A Member: Have you had any experiments with bend tests on this iron-copper wire?

Dr. Gonser: Yes, in all cases we used the general bend test of wrapping it several times around itself, and if it could not take it we paid no attention to it. It was too brittle. In some cases where we found too much brittleness in some of the alloys, we found by heat treatment we could stress-relieve the alloy. But all these compositions and figures that I have given you are for material that had been given the bend test and were considered good.

Chairman Roth: If there is no further business, the meeting today will stand adjourned.

★ ★ ★

New Bolt Tester Announced

A new type bolt extensometer designed for accurate tensional tests of bolts without the influence of shifting of grips or seating of the specimen, is announced by **Baldwin-Lima-Hamilton Corporation,** Philadelphia 42, Pa. The new instrument was developed by R. H. Pinkel, Research Metallurgist, International Harvester Company, Chicago, for testing the many sizes of threaded bolts required by the company. Slight refinements have been added by **Lawrence Hyde, O. S. Peters Co.,** Washington, D. C., to provide unrestricted movement of extensometer arms.

★ ★ ★

Since the method of attaching extensometer arms to standard cylindrical specimens cannot be applied to threaded bolts, attachment has sometimes been made on the grips. Any shifting of the grips and seating of the specimen, therefore, distorts extensometer measurements.

★ ★ ★

To avoid the possibility of such errors the new extensometer has been designed to contact the center of the ends of the bolt, thus making direct and exact measurements of elongation. If the extensometer is left in position until actual ffac-elongation curve can be obtained, showing ultimate strength and overall elongation.

★ ★ ★

Fourth Issue of Heat Treat Review

If you have not already had a copy of the "Heat Treat Review", published periodically by **Surface Combustion Corporation,** Toledo, Ohio, here is your opportunity to receive a copy. This comprehensive, well-illustrated magazine should be of interest to all persons concerned with heat treating processes.

★ ★ ★

Each issue contains reliable information on the latest processes and the most advanced fuel-fired equipment. The fourth issue, Vol. 2—No. 2, which is now available, features such timely articles as Batch Furnaces for Continuous Production and Protective Atmospheres for Annealing Non-Ferrous Wire.

★ ★ ★

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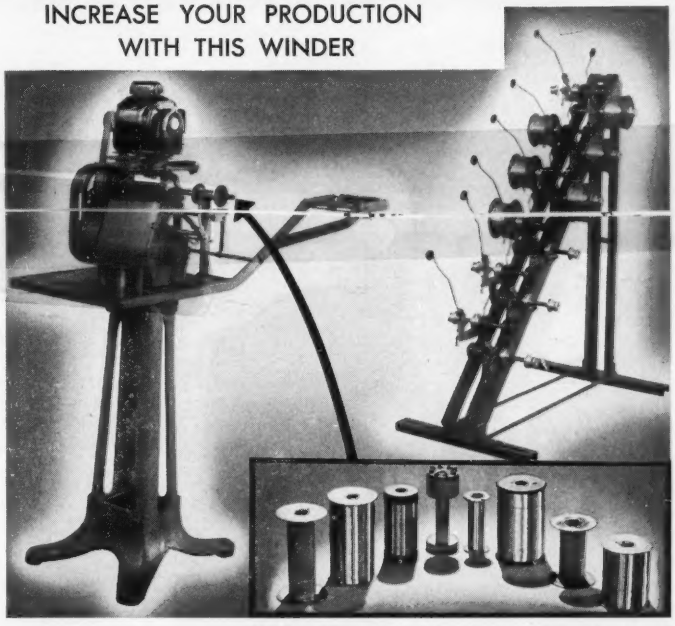

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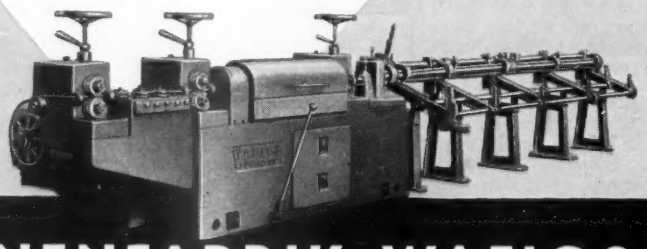

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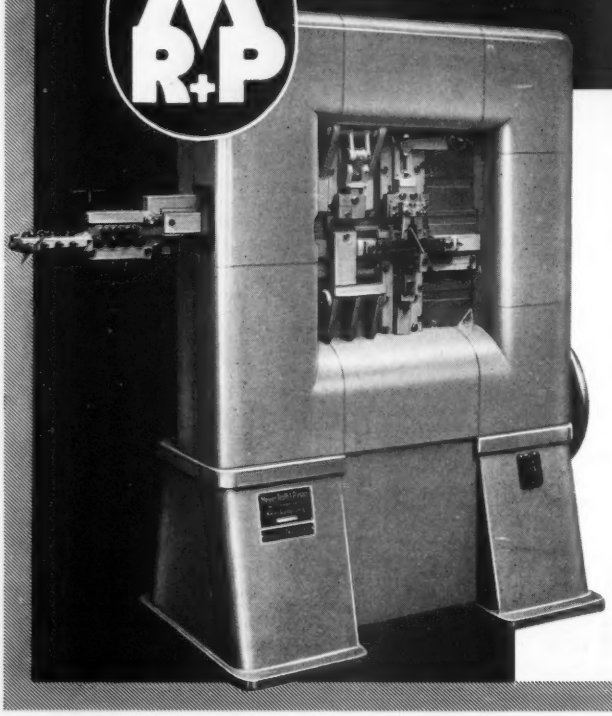

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Bulletin 400 describes their thermoplastic crosshead machines, with therma-fin jackets and control panels. The folder, with the four bulletins will be sent to interested persons upon request to the company.

Tuesday, P.M., Discussions Non-Ferrous Session

(*Continued from page* 55)

(Mr. Dresser presented his paper.)

Mr. Wiltrakis: We are indebted to you, Mr. Dresser, for an interesting paper on an important new development in the preparation of plastic materials for extrusion. Would you like to ask Mr. Dresser any questions?

A Member: What savings are there from the processing of the PVC compounds by your method?

Mr. Dresser: This method of preparing insulating materials saves the use of a Banbury mixer, a sheeting mill and cutting-up equipment, besides which, one man can handle a properly installed plant capable of preparing 1400 to 1500 pounds of the compound per hour. Other economies I have already discussed in my paper.

Mr. Wiltrakis: Thank you, Mr. Dresser. If there are no other questions, this session will now adjourn, and our meetings are concluded for today.

A Member: I believe you said your process eliminated porosity. Will you tell us something more about it?

Mr. Dresser: There are two things that contribute to the elimination of porosity. The first is sifting. This is definitely necessary to break up the agglomerates in the material that has been received from the supplier. It is in itself a good blending operation in that it does break the material up—the particles are easily broken as they are comparatively soft. Any nylon brush is capable of doing it with very little pressure against the screen. The second is the use of the attrition mill, through the use of which a very uniform material is produced with a smaller percentage of residual agglomerates than any system I have yet seen.

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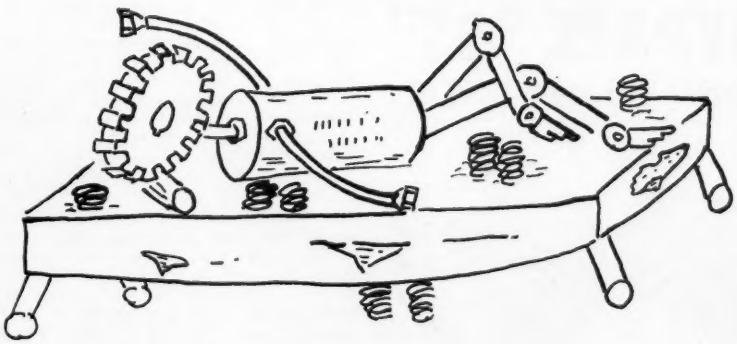

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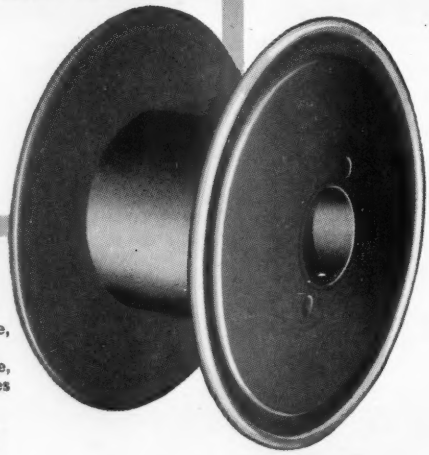

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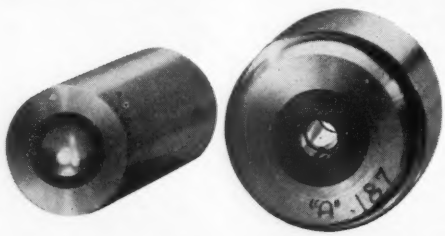

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(*Continued from page* 52)

the hardness in the 300?

Mr. Dill: I don't believe we will raise the hardness enough to affect any future processing, but we will not run chrome nickel through at that speed. The scale condition on chrome nickel is a little tougher, although we are running the chrome nickel alloys in strip form at 60 to 75 feet a minute, but we are getting a lot more abrasive on the surface too.

A Member: What would the cost of one of those triangular units be for a single strand of wire?

Mr. Dill: That little machine there is about $8500 complete, with all the electrics and dust collector. It is a packaged unit you might say.

A Member: In the case where the rods were drawn for low carbon rods for nail wire can you give the finishing speed of the machine?

Mr. Dill: The speed of cleaning for that type of nail machine is somewhere between 16 and 20 feet a minute.

A Member: How does grease affect the surface for Tru-Steel shot blasting?

Mr. Dill: Very definitely so, if it is of any great magnitude. A little thin film of oil won't make any difference, but if you have any large quantity of grease when the shot hits it, it acts as a cushion and you don't get that area clean. It is very much the same thing as when you are pickling a cold rod and the rods are not agitated enough to separate them. You get a black spot there. The grease acts as a cushion, but most of the time if it is wiped off well it will serve the purpose.

A Member: In the schematic diagram of the rod cleaning machine you showed—there are really two questions I have in mind—when you showed that slide you said it had possibilities to set up behind a rod machine. In other words, clean and draw in the one pass of the rod. To any of us who have a long row of rod machines down the room that looks a little unfeasible; that is, one machine for each rod drawing machine. Do you have any machine or does it have any possibility of immediately following the heat treating furnace where you have a large number of strands passing through?

Mr. Dill: Yes, it very definitely does. As a matter of fact, we are designing a machine for Wickwire, Spencer in Massachusetts right now for that purpose, cleaning 30 strands at an average speed of about 25 feet a minute. In that case the design is slightly different from that shown. We have to group our wheels a little differently to get coverage on the 30 strands, spaced about 1½ inch centers. We have also designed machines for 45 strands for the same purpose. We have run considerable tests on a patented rod and have proven very definitely that we can take all the scale off and give a very excellent surface for cold drawing, particularly high carbon rod. We have done a nice job on that.

Chairman Parkin: Thank you very much, Mr. Dill. I am glad to hear the discussion which goes with these papers. It is very important. The papers themselves are always satisfactory, but it is the thoughts that go on in your minds during the papers and that come out later as questions that make them satisfactory.

To introduce our next speaker and our next subject I should like to quote from

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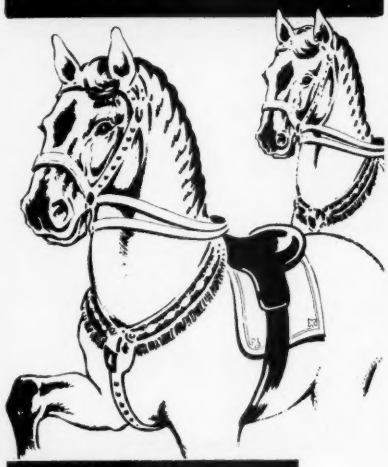

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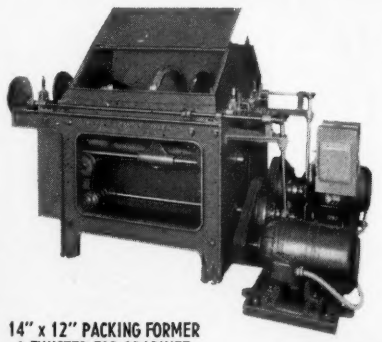

14" x 12" PACKING FORMER & TWISTER FOR GRAPHITE APPLICATION

Steel Magazine, the copy of August 27, page 71, which discusses acid consumption in pickling. It states:

"Savings of 25 per cent in sulfuric acid consumption and a 24 per cent increase in tonnage of steel cleaned are reported by one user using a new liquid acid accelerator in the pickling tanks. Prior to the use of the accelerator 600 gallons of acid per day were used in this one particular operation. Following the application of this liquid accelerator the figure dropped to 450 gallons per day. The nation-wide shortage of sulfur and sulfuric acid makes this development particularly timely."

Again from News Week Magazine of June 25, page 61:

"Steel companies meanwhile are learning how to stretch their supplies of sulfuric acid. Typical is Allegheny Ludlum Steel Corporation in Pittsburgh. This firm has learned that it can prolong the life of its acid appreciably by treating with other chemicals which are in adequate supply."

Obviously in both cases the product is not named, but the product is called "Azed," produced by the Azed Corporation in Waukegan, Illinois, a company jointly owned by the Acme Steel and Poor and Company. This product is something brand new. The paper should bring out a lot of discussion later on.

The subject then of the next paper is "Depolarizing Agents and Their Effects and Savings in Cleaning of Rods and Wire." I am happy to present for your second paper of the morning, Mr. Joseph T. Irwin, Chemist for Azed, Incorporated. Mr. Irwin.

(Mr. Irwin presented his paper.)

Chairman Parkin: Thank you, Mr. Irwin.

Gentlemen, the meeting is now open for any and all questions or discussion. If you have any points or bones of contention or arguments—

A Member: Mr. Irwin, in your report you spoke of the use of 1:1 muriatic acid or sulfuric acid.

Mr. Irwin: No, I am sorry. The monographs were made with 1:1 muriatic acid. It is a simple thing to show somebody quickly in the laboratory the rather marvelous effect of one part in 1,000 of these depolarizing agents. You see a sudden gassing action right under your nose, you might say. In the pickling of the scale is where we had the slide showing complete removal of scale in a given time. For those slides that work was all done with sulfuric acid, which is the most common practice we find in scale removal.

A Member: In other words, that reagent will hold for either muriatic acid or sulfuric acid?

Mr. Irwin: Muriatic acid or sulfuric.

A Member: I should like to ask Mr. Irwin about the fumes condition in the cleaning house because that is always a problem. Does that have any effect on the fume condition in the cleaning house?

Mr. Irwin: How well I know! The Azed additives that we spoke of in the paper do not have any foaming characteristics. They are not wetting agents. They do activate the acid, and if you maintain the same acid concentration as you had been using, then you get more acid spray from such a setup. We have had to work with a number of materials to develop a good foam blanket. We think we do have one now in a new product that frankly was developed a week and a half ago. We have had experience in two plants. It looks as though this is going to put the necessary blanket on top of the tank. I know in rod cleaning you have large

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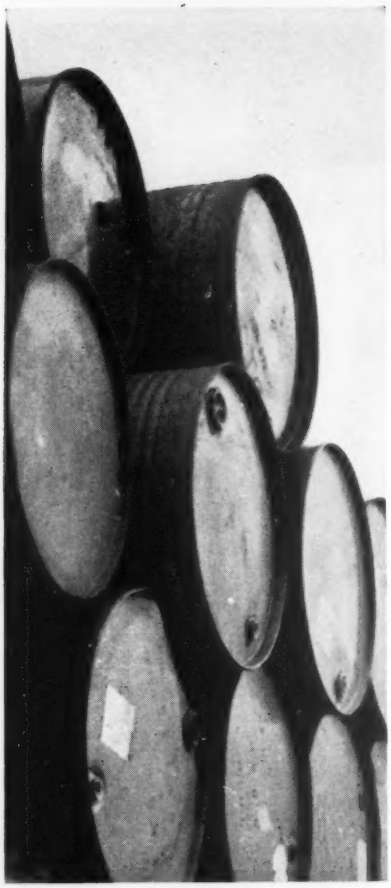

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tanks. Quite often they are square in design and large areas and you do have fume problems. We think we have a foam blanket now to go with this product. We need more time.

Chairman Parkin: In that connection, Mr. Johnson, I am familiar with what happened in your plant. We have run this in a rod and wire mill in the Pittsburgh area, using a foaming compound along with the Azed to see if the foam would stay up and it did, which proves again that it will work in one mill and it won't work in another mill and you never know until you actually put it in and try it whether you are on the right track.

A Member: I should like to ask Mr. Irwin two questions. First how much depolarizer do you add, because there must be some fairly constant figure for so many pounds of Azed? Secondly, when you use the depolarizer what effect does it have on the inhibitor? Does the inhibitor break down under certain conditions?

Mr. Irwin: In the first place the quantities used of the liquid depolarizer discussed in the paper normally are in the ratio of one-half gallon per thousand gallons of pickling solution regardless of the acid concentration. In other words, you can make up a 5 per cent acid bath or a 10 per cent acid bath. It filtrates one-half gallon per thousand gallons of pickling solution; therefore, our experience has indicated that it requires a half gallon of the additive for every thousand pounds of sulfuric acid added for maintenance of the bath. There have been other products developed since the paper was written. We feel we have a much better product in a dry material now and that will be added at the rate of ¼ per cent of the acid weight.

Regarding the effect of inhibitors, the principle of depolarization and activation is so entirely opposed to the principles involved in inhibitors that we do not feel the two mix very well.

Mr. Chester is here. Perhaps he could help me out. He is the Research Director of Promat and Azed.

Mr. Chester: I would answer that question by stating that you cannot go backward and forward at the same time. A logical action develops in the fact that in the acid bath you clean a major portion of your scale rather rapidly, exposing a whole lot of bare surface. That, of course, led many years ago to the development of these two hundred odd materials in inhibitors. During that time activation would cause a faster rate of gain of iron and the economics of the thing would be backward unless you compensated in the depolarized bath by either dropping the temperature or concentration of acid or preferentially both. There has been some use in these last two years of test period of an inhibitor during the early time of the pickling cycle—that is that period up to the point where an inhibitor normally does not work very well—and then finish off with an activator. That has been done and it works very well.

A Member: Has Azed any application for pickling of stainless steel?

Mr. Irwin: Yes, it has. As a matter of fact, the first production work done with this material was in the stainless steel field. Two of the largest producers of stainless steel used this type of depolarizer in pickling their hot rolled and heat treated sheet and plate and found again the same things we have been talking about. They decrease their acid consumption per ton; they increase their tonnage

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per hour. At the present time it is nice to talk about that, but in the meantime we have lost both mills because they have gone to the more logical method of taking off scale from stainless steel and that is by the fused caustic processes, the Hooker and DuPont processes. I really think that is the best way to handle stainless steel anyhow. I do not blame them, but for three years in production they did use this additive very successfully.

A Member: You just made the statement that the mill that was using your stuff switched to the caustic process. Do I infer from that that your material is not beneficial in the removal of oxide from the Hooker process of which I happen to be a user?

Mr. Irwin: I do not quite get that.

A Member: You put your steel in the Hooker, quench, wash, muriatic, nitrate. You still have those processes to go through even though you do have the Hooker?

Mr. Irwin: In the final pickling we get off that last bit of black smut. Yes, the Azed additive helps greatly. What I meant was that they normally had been pickling in either straight sulfuric or had followed a rotting practice, that is, they put the product in a permanganese solution and let it stay there for so many hours, then took it out and pickled it in order to get that alloy scale off. Where they had been doing that they found that the addition of the Azed additive decreased pickling time and increased production. They still went through the nitrate bright dip. In your case or in the case of using the Hooker or DuPont or any of those, where an acid dip is required after going through that process, yes, this will help materially in getting a clean surface.

A Member: I should like to put some figures on the blackboard, if I may, Fred. We ran some experiments with Azed at Roeblings, and after working a while I should like to tell you something we did about the middle of the experiment. In other words, I am going backward. We noted the effect of acids with Azed additive and there was quite a reaction. In other words, the fine hydrogen bubbles described by Mr. Irwin were produced, and rather violently I might say, in comparison with an inhibited acid or a straight acid. So, as a matter of curiosity, we took some strips of cold rolled 70 carbon steel, merely to see how much of an accelerator it was without any scale being present. On the board here I have the composition of the acid solution, the per cent acid being by volume, pounds per gallon of iron. Then the per cent weight loss in sulfuric with Azed added and the per cent weight loss in straight acid with no Azed. As you can see, there was a terrific acceleration more or less with the acid solution. In other words, at 8½ per cent by volume sulfuric solution with temperatures at 150°, the strip that was placed in the Azed lost 40 per cent of its weight, and in the straight acid it only lost 7 per cent. With your acid going down and your iron up to ½ pound per gallon, your Azed loss was 28 per cent; with straight acid 5 per cent. Then with the acid down to 1½ per cent and the iron up to 1 pound per gallon, the Azed loss was 7.86 per cent and the straight acid was .86 per cent.

There is one question I should like to raise at this time. This is the reaction on bare steel. While you are pickling rod or any other scaled material there is an

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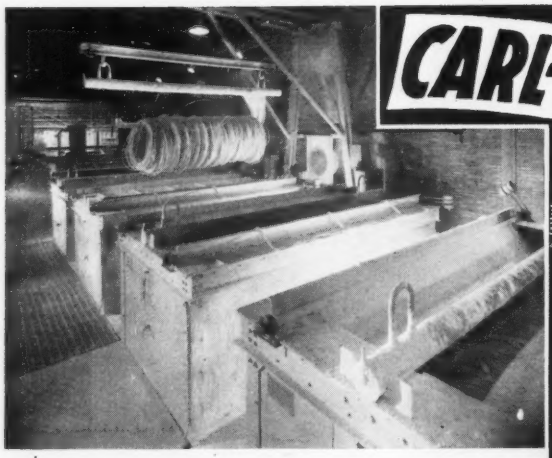

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interval of time in which you have an appreciable area of bare steel present until all traces of scale are removed. These figures would indicate that you are removing iron from your bare areas at a pretty rapid rate. Now then, do we have to consider how much iron we are throwing away into the solution in order to gain more use of the acid? I think that is an important point that should be given more study. I should say recognition should be taken of the counterbalancing of the loss of iron versus the gain in acid. I think further, based on these figures, that we should have the presentation of a curve showing how rapidly your iron builds up in your pickling solution as compared to either an inhibited acid or a straight acid.

Our initial trials on this material were laboratory trials. We were cleaning raw rod, 70 carbon raw rod, and we made several trials using a constant acid, and increasing iron, and we made several trials using a decreasing acid and increasing iron. When we compared acid against an inhibited acid we could not check our results. In one run we showed as the iron increased the relative time for pickling with an inhibited acid went up. We made a second run after that and we showed about the same time for inhibited acid versus the acid with the Azed added. After we had gone through that part of the experiment we then forgot about inhibited acids altogether. Since Azed is not an inhibitor why compare the Azed with an inhibited acid, because no doubt you can use straight acids if you are careful? I draw as an analogy of that the present use of boron steels and alloys. Heavily alloyed steels are very handy because you can be careless and sloppy with them, but with the lean alloy steels you can do a good job only if you are careful.

We worked further with straight acid and Azed and while we did not go up to extremely high iron contents, we did find some values which raise a question and probably need more study as to the true value of Azed in the wire industry. I have a few figures here where we cleaned raw rod in Azed versus straight sulfuric acid with a rather low acid concentration with increasing iron. For example, with 3.7 per cent acid and .33 pounds of iron per gallon it took nine minutes for both types of acids. With the acid dropping down slightly, 3.3 per cent, and iron going up to .41 per cent, it took 11½ minutes in Azed and 9 minutes in straight acid. Going down to a still lower figure, with 2.2 per cent acid and about .46 pounds of iron per gallon, it took 18 minutes with the Azed and 18 minutes with the straight acid. I realize that the Azed is supposed to be effective in cleaning with solutions containing higher amounts of iron and we have gone up to those higher amounts of iron, and although there is some indication that it will clean, I still feel that the question of more rapid iron solution and bare metal surfaces must be studied more thoroughly before we can accept this material as an acid saver.

One thing I am curious about to some extent is that Mr. Irwin mentioned a mill, cleaning high carbon rod and getting normal acid consumption figures in the range of 55 to 60 pounds per ton. That figure seems rather high and it has been our experience at Roebling's that with an inhibited acid our normal consumption has been over a period of years about 34 pounds per ton and we have gotten it down as low as 27 pounds per ton. That is rather a great discrepancy between the figure quoted, 55 to 60, versus our own

experience without using any Azed accelerator.

I have one further point I should like to question in this paper, and that is on the two photomicrographs that were presented on the galvanized wire. If the conclusion that was made was based on just these two photomicrographs, I don't think it is a valid conclusion. I think that conclusion would have to be based on a study of numerous micrographs. For example, there is enough difference in the actual surface preparation of these two photomicrographs to raise a question in my mind. You will note that in the one photomicrograph representing the material cleaned in the Azed solution your scratches are at right angles to your galvanizing layer and seem to be of a different depth than the scratches shown on the sample cleaned in straight acid which are also running in another direction. So the possibility of creating smear lines and distorting those edges is quite great if you just base your conclusions on these two photomicrographs. I would feel much happier if it was said that this conclusion was based upon a study of a relatively large number of samples.

I hope I haven't thrown too much at Mr. Irwin at one crack and without any preparation.

Chairman Parkin: Do you want to take it up here, Mr. Irwin?

Mr. Irwin: Well, picking up one of the last points first because it comes to me rather quickly, you have something else to shoot at. I came out of a mill last week. On high carbon rod they are down to 15 pounds a ton, so you still have something to go. That is not with Azed either. To clear that point up, however, the figure I quoted of 55 to 60 pounds a ton happens to be the average figure for this particular mill. I would guess that probably 80 per cent of their tonnage is low carbon steel. The other 10 per cent is high carbon steel. I suppose there are mills that just run low carbon steel, but I haven't found them yet. Mostly they have some per cent of high carbon steel in their work. As a matter of fact, it complicates things sometimes trying to analyze just what you have done because you don't know what part of the pounds per ton figure goes to high carbon and the pounds per ton that go to low carbon figures.

To get back to acid acceleration, this type of material, a depolarizer of any type definitely will act as an accelerator of action of acid on steel. That is very definite. We have done it time and again, and I have drawn any number of curves from laboratory data on different types of steel. As a matter of fact, an increase in the amount of the depolarizer increases the amount of acid attack on steel itself. However, there are some things that we cannot get away from. In a report just the other day from a mill that normally pickles around 125 tons of rod in a tank before they dump it, they tell us they took 432 tons of rod out of that same tank. They tell us that they increased their iron concentration by 50 or 75 per cent and that they were still able to pickle commercially and economically.

Acid attack on iron, getting back to that again, yes, you attack bare iron with this type of acid, probably more so than you do so with the regular type of acid. However, you still end up with the fact that your pounds of acid per ton are always lower than even inhibited acid practice.

Have I covered most of them.

Mr. Chester: May I get in here just a

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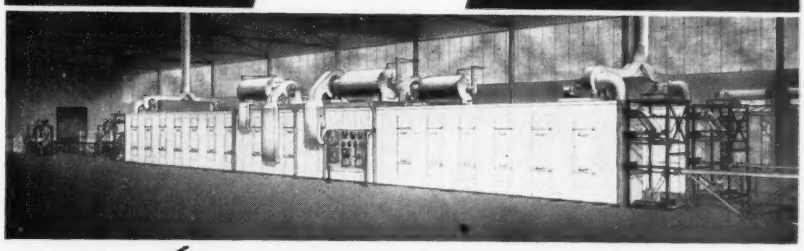

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minute on this galvanizing thing, Fred? We have been in production of this material at a major company, one of the larger galvanizing mills, for two years time. At the same time we have run this preparation for electrogalvanizing. I think I can assure the gentleman from Roebling's that there have been literally hundreds of these interfacial, interlayer studies made. I think Irwin's samples were unfortunate because I also noticed that one was up and one was down. I believe you did not prepare those and they were prepared by a customer using the material. Is that right?

Mr. Irwin: That is right.

Mr. Chester: So I would not have much comment on that. I do not think there is any question of this business of affecting an intermetallic or bimetallic layer, whatever you want to call it. That has been a good fight for a great many years. I do not think there is much evidence in this thing that would support any basic change on the surface. However, we have used the product commercially for three years in most of the plating in zinc that goes on in alkalin and acid zinc in the Detroit area and have consistently found better adherence of any layer that is applied over that surface. That primarily is due to a study that was made by Dr. Ewing. I think you may be familiar with the electro-beam refraction study and the fact that clean steel is never clean. You cannot even put steel in an alkaline cleaner and take it out and not have an oxide layer on it. I think the point Irwin made is a very good one. If it does not do anything else it certainly affects fluxing and that is well borne out by Dr. Ewing's study. So if there is any effect in an activated pickle of this type on adherence in galvanizing, it is simply due to a change in two factors. One, the fact that you have a far more uniform etch. You have a depolarized deal here. The second thing is you probably have a lower incident and a lower layer of delta and gamma iron oxide that were clearly established and measured. They are very thin. You cannot see them but they are there, gentlemen, on all pickled wire or clean wire. When you go to galvanize it they interfere unless they are taken off. That perhaps might clarify the position on this intermetallic layer business in hot dip.

Actually the product, as I said, has been used in a very large galvanizing operation for a period of eight months, and the figures that Irwin gave are accurate and taken from production and not from laboratory tests.

A Member: Did the Azed people make any comparisons with uninhibited acid? In other words, just raw acid? We have gone from one extreme, an inhibited acid to an accelerated acid. What do we do without anything added to it?

Mr. Chester: I can answer that. At the first part of the pickle cycle the uninhibited acid may be even faster than a depolarized pickle. The difference begins at about one-half pound of iron, and then they follow very well the curves that Irwin showed with fair activity. The influence of this material probably lies in the activity of the acid as the iron increases in the bath. There is an old concept. I think all of us for a good many years have thought of this pickling thing as something simple. Actually, chemically it is not simple because you never have any equilibrium. The iron is going on. Your temperature is changing. The whole bath is in a state of non-equilibrium. The effect of the depolarizer is probably much more noticeable when you get up into

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high iron and, as I mentioned before, there is a growing use of what is called "run your tank out." Work has been done with joint inhibitors, but in every case the economics would beat the acid alone.

A Member: I have one other question. As far as the actual pickling operation goes the most expensive item is one that is barely mentioned. That is the loss of iron. Have you worked up any charts on the cost in terms of loss of iron, using Azed against using an inhibitor? I think that is what Rudy Herzog was getting at.

Mr. Chester: Yes. I think that is a very good point, that you cannot start where your activity is such that you are going to lose a lot of iron in the early stages primarily. I know the samples that Mr. Herzog worked with. That was the product shown on the charts that Irwin had here. That activity was put at maximum at the start of the bath and then just carried on through. That we have learned is a mistake and economically is a fizzle. You will go faster but you will spend money on iron and on making ferrous sulfate which you do not want to make. So at the present time we supply this material in three grades of activity. That is, ranging practically from what you might call an inhibiting type of bath up to the maximum depolarizing effect that can be had, and in that way the work of the last few months has shown much more favorably from a dollars and cents standpoint than it did in the first work that he is reporting on. The early work was practically in the mills, and many of the mills that he quoted have representatives in this group. They were successful operations, but they were successful because they could affect one variable primarily. They could get a load of pickle work out of the tank faster. In other words, they raised the activity and pickled a shorter time. That was why in our opinion most of the actual acceleration came out dollars and cents wise in some of these mills.

A Member: You say it is a saving. I mean is it a 25 per cent saving or a 50 per cent saving?

Mr. Chester: I can quote you the figures of the most successful instance of its use over a period of time. In a major mill the saving in acid I believe ran 24 per cent and the increase in production I believe was 25 per cent. I think you are familiar with those figures.

Chairman Parkin: That is correct. In the interest of good reporting we should say those statistics are from the Allegheny Ludlum Steel Corporation and approved by their Research Department and their Public Relations Department on silicon sheet steel. It would be misleading for everybody to think that could happen to rod and steel.

A Member: You said 25 per cent. We use approximately 20 to 25 pounds of acid per ton to clean. That means 5 cents a ton. How much extra cost for the iron that is going to be used?

Mr. Chester: That would be difficult to say.

A Member: That is where the balance would have to come in.

Mr. Irwin: If you are using less acid you are eating less iron.

Mr. Chester: We must make ferrous sulfate out of it or else throw it away, one of the two things.

Chairman Parkin: Are there other questions, gentlemen? If not, our sincere thanks to Mr. Irwin for his fine presentation. It certainly opens up a new field for people who are pickling and familiar with the normal inhibitors.

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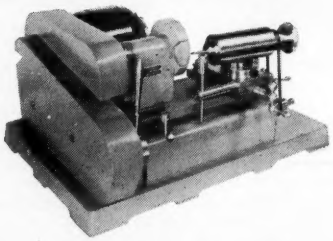

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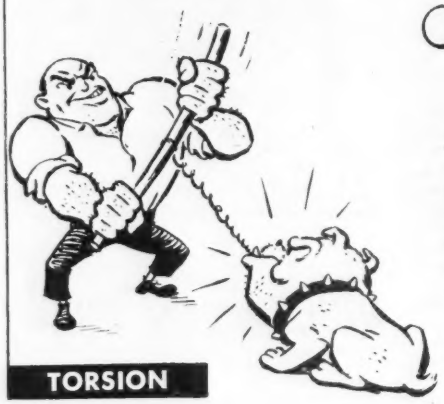

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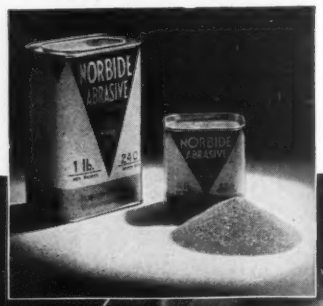

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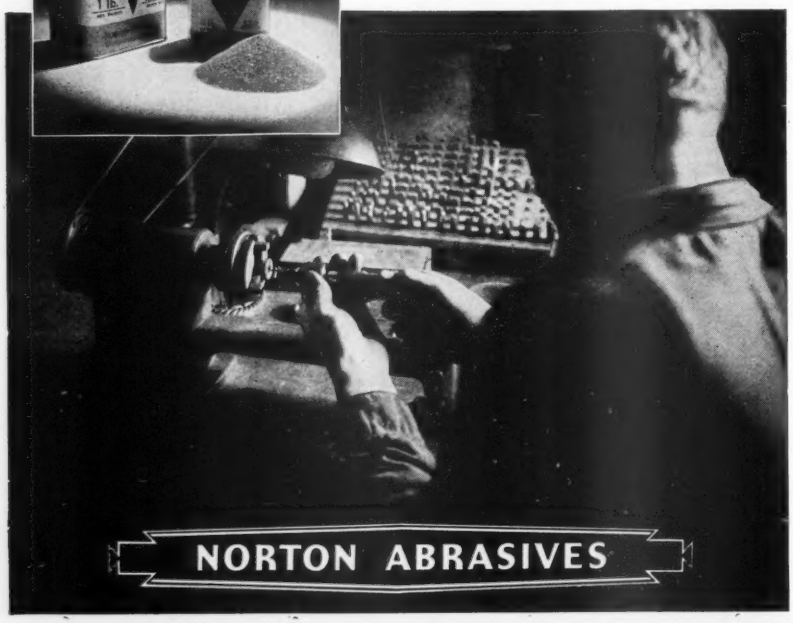

NORTON ABRASIVES

Wednesday A.M. Discussions
Non-Ferrous Session

(*Continued from page* 57)

A Member: There is a little relief in copper from wires made by copper coated steel wire. Copper-weld wire does a wonderful job in that and it gives some relief. Our company is trying to help in this by copper electroplating steel wire, which will contribute some to the alleviation of the copper shortage.

Mr. Nichols: That is very interesting. As a matter of fact, Copper-weld wire has helped substantially, and I expect that they will continue to produce as much as they can, for wherever it is feasible to use it.

A Member: Will the relative price of aluminum change in relation to the other metals as the result of a new capacity going into operation. Of course, we all realize that inflation is here, but can you tell us something about the future relative price of aluminum to the prices of steel and copper?

Mr. Nichols: Dave, what do you think about it?

A Member: I think that aluminum will fare well by comparison by virtue of the fact, primarily, that aluminum has not skyrocketed in price in comparison with the prices of other metals. I speak now of copper, zinc, and tin. The aluminum curve has increased, but if you will look at your statistics you will find the increase has been a very modest one. If you get these additional facilities available and the suply becomes far in excess of the demand that, obviously, would bring about some reduction, but should there be any reduction, I think it will be a very minor one. We do not look for any great decrease.

A Member: Are there any developments in the use of aluminum wire in cables recently that might make it possible to accelerate the use into aluminum wire and cable? Aluminum wire should be easier to draw. That may be one factor in its favor.

Now, there may be other developments recently that might be of interest to the members, such as connectors. That is a problem with which all of us are concerned.

Mr. Nichols: Isn't it a problem of getting the tremendous number of electricians familiar with the new techniques that are required to handle aluminum in the field; they are considerably more involved than just soldering copper. Would you like to comment on that, Dave?

A Member: Well, that brings up a point. It is not so much the trouble of educating the electricians themselves. The trouble is that in every community of any size there are different codes and different inspectors, and I think, as many as you gentlemen know, they can either promote or kill any new product for transmission; to get these local inspectors sold on aluminum has been one of the hardest tasks.

We have had trouble in the development of good connectors, but the trouble that we have had in developing them is nothing compared with the trouble we have had with the local boards and their regulations, and that is one job for which the industry is really going to have to take off its coat, in order to get aluminum accepted.

Mr. Nichols: Mr. DeKlyn said, too, as more companies become interested in ag-

gressively selling aluminum, the producers will have a great many more people educating these various building inspectors, and that definitely will help.

A Member: I have a comment on the connectors. Although the solder problem has not been whipped, there has been considerable progress made in getting solders that will not only unite aluminum pieces, but do so without too much corrosion. It has been rather easy to solder aluminum, but it has been very difficult to keep the parts from corroding under moist conditions. Possibly the greater development in that connection has been the one of cold welding, where by pressing to upset the materials possibly 50 per cent, you can get a good joint with rather simple equipment.

Mr. Nichols: I think, Jack, that we stand in your debt. Thank you for your very fine paper.

Mr. DeKlyn: I want to thank you gentlemen. It has been a pleasure.

Mr. Nichols: We next have a paper to be presented by D. M. Schmid, Vice President and General Manager, Alloy Metal Wire Company, Incorporated, Prospect Park, Pennsylvania.

The title of Mr. Schmid's paper is, "How Development and Research Have Created New Markets for Nickel Base, Nickel Chromium, and Chromium Iron Alloys".

(Mr. Schmid presented his paper)

Mr. Nichols: That was a very interesting talk and I am sure there are a number of questions the audience would like to put to you.

A Member: The alloy, Almet 18-4-6, you spoke about as being spring tempered, can it also be furnished in soft temper?

Mr. Schmid: Yes. It can be and it is being used by a few of the wire weavers now, which is a good example that it can be made soft enough for fine industrial wire cloth.

Mr. Nichols: Isn't it so that during the last war when the "N.E." steels came into play to save alloy elements that were critical, it was discovered that in many cases the "N.E." steels gave equally as good service as some of the higher alloys and to some extent there has been a tendency on the part of the metallurgists to keep themselves out of trouble by unduly enriching the alloy mixtures?

Mr. Schmid: That is true. However, nickel does have unusual properties. With the higher nickel alloys you don't have to be as careful in your shop furnace temperatures. The shop practice that you can use will lower your cost in most cases. That is true in the automotive industry, and those boys are pretty cost-conscious. They use a lot of nickel-containing steels because of their shop practices, which result in a lower cost of the finished part.

Nickel is used in more than 3000 regularly available commercial trade name metals. It does impart unusual properties to all these metals and that is why it is so hard to substitute other metals for nickel.

Mr. Nichols: What do you consider, next to nickel, the most useful alloy element to be?

Mr. Schmid: Probably chromium is in the same category. It is used even more extensively than nickel. The question is a hard one to answer. For instance, manganese will also impart the austenitic properties of the stainless steel, and in the case of Almet 18-4-6, it is used to replace nickel.

Mr. Nichols: Is there any particular use

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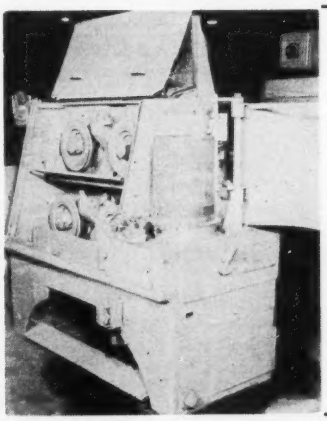

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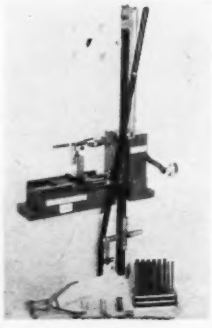

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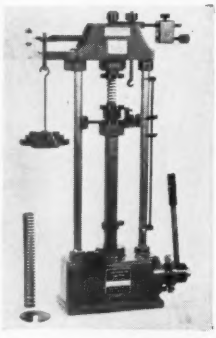

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made of cobalt, for example, another very critical metal?

Mr. Schmid: Cobalt is used on your jet engine parts, but there again cobalt is in even shorter supply than nickel, so you can't use cobalt as a substitute during the present emergency. And another thing that makes nickel popular is it is priced so low in relation to these other metals.

Mr. Nichols: Have you done any other work with titanium?

Mr. Schmid: Yes. That is a good point to bring up. Titanium does have a great future, and I think it will be used in our business very extensively some day. I think its cost will drop a lot. It can, perhaps, be likened to aluminum thirty or forty years ago, or a little further back when aluminum was around $5.00 a pound. I think titanium on a long term will come down and be a commercially available metal at a reasonable price. Just as a guess, perhaps fifty cents a pound. There is a lot of work to be done on it. There are about sixty or seventy different companies working on titanium and with all that effort there are bound to be great strides made.

Mr. Nichols: Has your company or anybody in the room had any experience with reference to titanium? Tell us about how it reacts, how it draws in comparison to some alloy like stainless?

Mr. Schmid: It is pretty tough to draw. We have used everything on it from oatmeal and molasses. It is tough. You can't take a high percentage reduction on it like you can stainless or any of your high nickel chromium alloys that are considered tough, but don't forget, twenty years ago we took one hole at a time on stainless steel. We will learn how to lick titanium.

A Member: About six months ago we had an inquiry from one of our customers for stainless steel wire cloth of fine mesh. They were unable to supply us with the priority rating and therefore we turned it down. Three months later we found that they were able to go to Sweden and buy the wire cloth and have it delivered in ninety days. Do you know the percentage of stainless steel wire cloth and wire that is coming to this country of 108 grade?

Mr. Schmid: Undoubtedly there is some of that being done. Sweden and some of those Scandinavian countries aren't as bureaucratic as we are, and they don't have all these extensive controls so the people over there run their businesses a little more than we do here, and there is probably some of that being done.

A Member: Isn't there a restriction on the importing of nickel into this country on stainless steel?

Mr. Schmid: Yes. The nickel is limited. There is nickel in New Caledonia. I believe the French have some deposits there and Russia controls the Finnish nickel.

Of course, some of the Swedish nickel might come from Finland. We have a gentleman here from France. I would like to ask him to comment on conditions there. He can probably give us a first-hand answer.

A Member: All I can say is that the nickel situation is as bad in France as over here. We have some nickel mines in New Caledonia which are mined and refined in France, but French nickel production has never been equal to our needs and we have always imported nickel, some from America, but we haven't been able to get any nickel from you for at least a year. The situation is much worse at home than over here now.

Mr. Nichols: That was a very interest-

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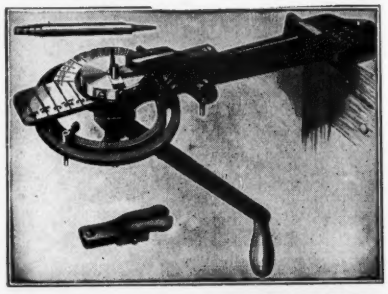

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ing talk, and we all thank you very much for it.

(Whereupon the meeting was adjourned.)

Wednesday A.M. Discussions
Ferrous Session

(*Continued from page 56*)

However, it was not until many months of laboratory testing that we found out what type of construction we had to employ to make the corrugated fiberboard walls. That was something else. We are now completely satisfied with the container. It has been adopted by the railroads, and I do not want to appear too aggressive, but actually the experience has been far more favorable than we anticipated.

A Member: You referred to the nail industry and the users there. What do you hear from, say, the mob, the people like the contractors and the carpenters? Have you had any objection to your type of container?

Mr. Oas: We had a lot of objections two years ago. Those objections pretty much quieted about a year ago. The development of any new fiber container or any type of package that is introduced into channels where there has been a previous form of packaging that has been in use for fifty years naturally is going to be subjected to questioning and suspicion; so there was quite a bit of market research undertaken by the International Paper Company among some of the early users of the container to determine just how much resistance there would be. There was surprisingly little. The advent of modern material handling practices—by that I mean palletizing, fork lift trucks, conveyors—all those things have gone into the distribution channels as well as into the mills, with the result that the package could be handled by most of the larger distributors. Those who could not use it two years ago made some minor changes in their warehouse handling and were able to use the package and, at the same time realize further savings of money in the handling of these packages.

A Member: The package, it seems to me, has a lot of possibilities, particularly if we do have a shortage of wood stays, as we did in the last war. We had to do a lot of hunting around for a new container. Some of us used steel kegs. Some went to plywood kegs. And some went to wire-bound boxes. But there is a problem I can see as far as the mills are concerned in the warehousing of the packages ahead of shipment. In packing the nails you must shake the keg and you will have to do the same thing with this box.

Mr. Oas: Obviously we have been doing that.

A Member: There is a problem here when you do that. Your keg is then not completely filled to the top. Your box is not going to be completely filled to the top. You are going to have quite an air space in there and if you stack those in the warehouse how are you going to handle the problem of supporting those packages when you don't have nails solidly up against the top?

Mr. Oas: That was a problem and that is why so much research originally went into the making of this container to determine what type of load had to be carried. We could not come to the nail mills with a million packages and say "You are going to have to fill each one

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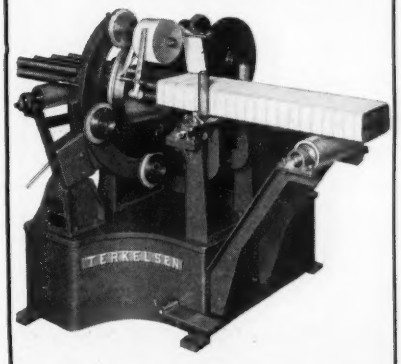

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right up to the top." The package is completely workable with a void.

One of the pictures shows No. 8's or No. 12's. If you will note there you have approximately 2½ inches of void. These containers are all of the same height. The adjustment for cubic volume is made in the length and width. Approximately 60 per cent of the compression load of the container is taken by that inner tube. It is the full length tube from top to bottom, that has to take the load that corresponds to the side walls of the wooden keg.

I might add for your further information every time you ship a container with a void in it you are throwing a nickel or a dime in on top of those nails. With a fiberboard package you have a container that enables you to eliminate those voids and accomplish savings in the size alone. Obviously, the best container would be one in which you could put 100 pounds of nails and they would be right flush with the top. It is impractical to do it with over 3,000 types of nails being made and four or five sizes of containers to put the nails in. So we did have to make a container that would meet the strength requirements to handle that void.

Nails can accommodate themselves much better to the square package than to a round package or a rectangle or hexangle. The nails have a tendency to lay in there much safer with the result that we come up with a much smaller package.

A Member: Are you going to have just one size package for all nails?

Mr. Oas: No, sir, all the packages are the same height. They are 14½ inches high. The adjustment is made in the length and width. For instance, No. 8 nails are packed in a package in which the outside dimensions are 9½ by 9½ by 14½.

A Member: How many sizes do you figure?

Mr. Oas: A West Coast manufacturer is using seven sizes. A Rocky Mountain manufacturer is using five sizes. A manufacturer in Kansas City is using four sizes. It is entirely dependent upon the range of nails that he packs, the amount of space that he has to give to warehousing, etc. You are dealing with a flexible product that is practically tailor-made for each mill. But the important thing was to keep that height the same so that in the jobber's warehouse when he has shipments in from two or three manufacturers he is able to palletize uniformly.

A Member: I can understand the height. Of course, the idea would be to simplify the number, too. Ordinarily we use four keg sizes and we certainly would not want to go beyond that. We would like to go to fewer.

Mr. Oas: Well, it has been found in some cases that it was practical to go six or seven and realize considerable saving of money. That is not of too much importance. It is entirely up to you. The container will work the way you want it to work.

A Member: Could you give us some idea of the cost of this container compared with kegs?

Mr. Oas: Keg prices vary across the country and I would just as soon not discuss it. I think that is common knowledge among our audience here.

A Member: I think it is rather important, though, don't you?

Mr. Oas: Well, it is. I would prefer to discuss my own prices, sir. The prices on

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those containers, taking No. 8 common nails as your standard, a 9″ by 9″ by 14″ —these are inside dimensions that I am giving you—is priced at 31½ cents delivered in carload lots and printed two colors, east of the Rockies. You can go up and down from that. You go up into your next size, which would be equivalent of a 10-10¼-17 keg and you will be at approximately 33 cents. You will find, however, that the bulk of the range of your nails in the square packages will be shipped in the 8″ by 8″ or 8½″ by 8½″ or 9″ by 9″ or 9½″ by 9½″ sizes. You are going to reduce your cubic volume considerably when you go to these factors.

A Member: How many nail mills in this country are using this carton exclusively as a method of packaging nails?

Mr. Oas: There are three today that are using the container exclusively, only one of whom is a major nail producer. There are three others that are better than 50 per cent on its usage and we believe within a comparatively short period of time will be 100 per cent on its usage. You are dealing with an economic factor that had to come about. You cannot ignore the savings in warehouse space, in makeup cost, the common source of supply, the availability of it. You cannot ignore all those things under today's high cost of doing business. Whether we or somebody else pushed it, this particular type of container was inevitable.

A Member: One of the big problems is the labor involved in wire tying. I understand that at least one producer in the states is using an automatic machine. Can you confirm that and give us any idea as to the complexity of that machine and perhaps its price?

Mr. Oas: Yes, I can.

I had some correspondence with your firm about a year ago, and just last night I talked to one of your men about some further developments. I think that your firm will be apprised of them in the next thirty or sixty days. But on wire tying of the package, the package will ship just as well with or without the wire tie. The wire tie adds nothing at all to the strength of the package. It is merely there to hold the cover and to guarantee somebody that he is going to get 100 pounds of nails with no pilfering. Originally we used two wire ties of 16 gauge that was applied somewhat automatically on a Squire R.Q. machine. Recently two companies have used Signode's Model L machine.

I think all of the ramifications of the package have not been fully explored, except that now there seems to be a crystallization of opinion that one wire

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tie is sufficient which, of course, eliminates reversing the package to make that second tie.

Thank you, Dick, for a very interesting paper, which I am sure is going to be helpful to all the nail manufacturers about the country.

The next paper has to do with patenting with continuous cleaning and coating. To me this is a very timely paper, for it is about ten years almost to the day that a couple of comedians down at Sparrow's Point tried the first, as far as I know, cleaning and coating after patenting.

We are very happy to have Chuck Williams with us to tell us of his experience along this line. He and Pittsburgh Steel have carried the continuous cleaning and coating to a little higher degree I think than anyone else. So it is with great pleasure that I give you C. H. Williams, Wire Mill Superintendent of the Pittsburgh Steel Company, Monessen, Pennsylvania.

(Mr. Williams, Jr. presented his paper on "Patenting with Continuous Cleaning and Coating.")

Chairman Crewe: There you are. Less transportation, less cost, better bundling, better cleaning, and more uniform coating. That is a lot wrapped up in one package. To my knowledge there is continuous cleaning and coating after lead annealing, that is, continuous cleaning and coating for drawing after lead annealing, after double lead patenting, and after air patenting. That includes the coating of liquor finishes, lime finishes, borax finishes, plus subsequent plating—almost anything you can think of.

A Member: We have been working with this problem and this continuing patent cleaning and coating for approximately five years. Red, you know about the starting of our unit. It is primarily on fine wire. By that I mean 16 gauge and finer. Some of our experiences have been transmitted to Pittsburgh naturally. I hope they have been of some help to them in their initial installation. We have a double lead patenting on fine wire and as such do not get the same effect with scale breaking that you would on the air patenting. As a result we find that in mechanical wiping in conjunction with the acid cleaning, it is important and it is a big help to use it because of the fact that we cannot get the same scale breaking you can on the air patenting.

Chairman Crewe: I take it, though, with double lead patenting a scale break isn't necessary.

A Member: We find that it is not because you don't get the excessive oxide film that you do with the air patenting.

Chairman Crewe: Thank you.

One of the other problems connected with this operation I believe is that of acid carry-over onto the finished product. Having had a little of it, I wonder if Pete Raffensperger would tell us how he stopped it.

A Member: Our unit is on double lead patenting with continuous cleaning and borax coating. With the acid cleaning you do have some carry-through and we use a fresh water rinse as it comes out of the hydrochloric acid cleaning. It works out fairly well.

I was interested to hear that Chuck isn't doing any drying of their coating. We do. As we come out of our borax tank we go vertically up through a gas-fired drier. Our speeds might be somewhat faster or else you are having more

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travel between the unit and take-up frame, but we have found it necessary to dry it. The wire that we produce on this particular unit is mostly used in a breakdown size for tire bead, spring wire and rope wire.

Chairman Crewe: Another question that probably pops into your minds is can you coat on the level or do you have to go up vertically to have a successful coating operation. I wonder if someone can tell us about their experiences. Dr. Lewis, I believe you people are interested in continuous cleaning after patenting. Would you care to make a comment or two on this subject?

A Member: We are installing a unit for doing this job but it isn't going yet. So we don't know what we are going to get into until we do have it in operation.

I was very much interested in Mr. Williams' comments about phosphate coating and he did not say too much about it. I should like to know whether it was better than the borax coating and which one he has settled on using.

Mr. Williams: At the present time we are using the phosphate coating. We haven't used it quite as long as we did the borax, but I really think it has better possibilities for use in our particular operation than the borax coating.

Chairman Crewe: Getting back to this coating on the horizontal and on the vertical, the only ones I know of who do it on the vertical are the boys up at Bethlehem in Williamsport. John Corson, do you have anything to say about the relative merits of doing it on the vertical or doing it on the horizontal?

A Member: We did have that experimental unit in but it was taken out. There are a number of operational factors which do not lend to its use in our plant. Since, we have gone from regular apex lime coating that was used on that unit to the use of phosphate coating, and the time required for phosphate coating, with the weight of coating which we desire, is so much longer, it is not feasible for us to do it in a continuous bath.

Chairman Crewe: I am sure everybody will be interested to know what the boys are doing over on the other side of the puddle. Reggie Brown, I know you have been interested in this game for a long time. Will you tell us a little about the experience over yonder?

A Member: We are building a unit like Dr. Lewis said for this job. We haven't done the continuous descaling and cleaning from the patent. We have only dealt with rods for wire drawing in that manner. Of course, one big firm in England has been patenting with continuous cleaning and coating for a long time and do it very successfully.

Are there any further questions? Who else would like to delve into this subject?

A Member: I should like to ask how they maintain control of the acid during the operation, say, from the time they make up a new tub until the time they have to dump.

Mr. Williams: Do you mean the temperature?

A Member: The strength control and additions.

Mr. Williams: It is checked twice a turn by our foreman in the patenting department. We have a little laboratory there to do it on either type of acid. The additions we try to do mostly on one turn to save labor. But we definitely maintain it above a certain strength and we don't go below that. We add about once a day.

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A Member: How long can you maintain a tub before you have to dump?

Mr. Williams: We are running now about five to six turns. That is, eight-hour turns.

Chairman Crewe: Probably the answer to that is the same thing that they do on hot galvanizing. This thing really is about as simple as cleaning before hot galvanizing. We all take that for granted. Why anyone should hesitate on the patenting is amazing to me, but on hot galvanizing, as you know, almost everybody does it by guess and by God. If the wire looks dirty we add a little something.

Are there further comments? We have a lot of experts and you can get a lot of free advice here today. If no further questions I should like to thank Chuck for a very fine paper on a very timely subject.

Chairman Crewe: If there is no further comment we will adjourn until the Mordica Memorial Lecture this afternoon at one o'clock.

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Elgin National Watch Co., Abrasives Division, Elgin, Ill.
Norton Co., Worcester, Mass.

ACID INHIBITORS—
(See Inhibitors, Pickling)

ACID-PROOF CONSTRUCTION—
Ceilcote Company, Cleveland, Ohio
Chemsteel Construction Co., Pittsburgh, Pa.
Haveg Corporation, Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio.

ANNEALING MACHINES—Open Flame
Syncro Machine Co., Perth Amboy, N. J.

ANNEALING POTS AND BOXES—
Scudder, E. J. Foundry & Mach. Co., Trenton, N.J.

ARMORING EQUIPMENT—
American Insulating Machy. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

BAKERS—Rod and Wire
Carl-Mayer Corp., The, Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
Ross, J. O., Engr. Corp., New York, N. Y.

BAR STOCK—Stainless Steel
American Steel & Wire Company, Cleveland, Chicago, New York
U. S. Steel Corporation, New York, N. Y.

BOBBINS—Braider & Wire Weaving
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Standard Mill Supply Co., Pawtucket, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

BORAX—Wire Drawing
Pacific Coast Borax Corp., New York, N. Y.

BORON CARBIDE—
Norton Co., Worcester, Mass.

BRAKES—Pneumatic
Entwistle, Jas. L. Co., Providence, R. I.

CABLE LACQUERING OVENS—
Industrial Ovens, Inc., Cleveland, O.

CARRIERS—Braider, High Speed
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

CASTINGS—Wire Mill
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.

CEMENTS—Acid Proof
Ceilcote Company, Cleveland, Ohio

CEMENTS—Refractory
Norton Co., Worcester, Mass.

CHEMICALS—Cleaning
(See Cleaners—Metal)

CLEANERS—Metal
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Phila., Pa.
Houghton, E. F., Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Metal & Thermit Corp., New York, N. Y.
Parkin Chemical Company, The, Pittsburgh, Pa.
Standard Industrial Compounds Co., Chicago, Ill.

CLEANING & PICKLING EQUIP.—
Ceilcote Company, Cleveland, Ohio
Chemsteel Construction Co., Pittsburgh, Pa.
Cleveland Tramrail Div., of the Cleveland Crane & Engineering Co., Wickliffe, O.
Haveg Corp., Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio
Holden, A. F., Company, The, Detroit, Mich.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio
Wilson, Lee, Engr. Co., Cleveland, Ohio
Youngstown Welding & Engineering Co., Youngstown, Ohio

CLOTH—WIRE, All Metals
Roebling's, John A. Sons, Co., Trenton, N. J.
Wickwire Bros., Cortland, N. Y.

COATING COMPOUNDS—
Apex Alkali Products Co., Philadelphia, Pa.
Houghton, E. F. & Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Pennsylvania Salt Mfg. Co., Philadelphia, Pa.
Standard Industrial Compounds Co., Chicago, Ill.
Trembicki Co., The, Chicago, Ill.

COILERS—Sheet, Strip and Wire
Entwistle, Jas. L. Co., Providence, R. I.
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Corp., Cleveland, O.

COLD HEADERS—
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

COMPOUNDS—Coppering
American Chemical Paint Co., Ambler, Pa.

COMPOUNDS—Diamond
Eastern Carbide Corp., New Rochelle, N. Y.
Elgin National Watch Co., Abrasives Division, Elgin, Ill.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Magnus Chemical Co., Garwood, N. J.

COMPOUNDS—For Improving Drawing and Extrusion
American Chemical Paint Co., Ambler, Pa.

COMPOUNDS—Metal Finishing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Metal & Thermit Corp., New York, N. Y.

COMPOUNDS—Phosphate Coating
American Chemical Paint Co., Ambler, Pa.
Pennsylvania Salt Mfg. Co., Philadelphia, Pa.
Trembicki Co., The, Chicago, Ill.

COMPOUNDS—Rust Preventing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Houghton, E. F. & Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.

COMPOUNDS—Rust Removing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Houghton, E. F. & Co., Philadelphia, Pa.
Standard Industrial Compounds Co., Chicago, Ill.

COMPOUNDS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Houghton, E. F. & Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H. Co., Inc., Homer, N. Y.
Nopco Chemical Co., Harrison, N. J.
Pacific Coast Borax Corp., New York, N. Y.
Pennsylvania Salt Mfg. Co., Philadelphia, Pa.
Standard Industrial Compounds Co., Chicago, Ill.
Swift & Company, Chicago, Ill.
Trembicki Co., The, Chicago, Ill.

CONDUCTORS—Flexible, Electrical
Montgomery Co., The, Windsor Locks, Conn.

COPHOLDERS—Steel
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

CORDS—Electrical, Tinsel Conductor
Montgomery Co., The, Windsor Locks, Conn.

CORROSION PREVENTIVE PAPERS—
Angier Corporation, The, Framingham, Mass.

CRANES—Wire Mill
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CUTTING TOOLS—Carbide
Carboloy Dept. of General Electric Co., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth-Sterling Steel & Carbide Corp., Pittsburgh, Pa.
Metal Carbides Corporation, Youngstown, Ohio
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.

CUTTING TOOLS—Wire
Porter, H. K., Inc., Everett, Mass.

DIAMONDS—Industrial
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDERS—
Danforth, The C. W. Co., Youngstown, Ohio
Eastern Carbide Corp., New Rochelle, N. Y.
Elgin National Watch Co., Abrasives Division, Elgin, Ill.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Indiana Wire Die Co., Ft. Wayne, Ind.
National Research Company, St. Claire Shores, Mich.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDER RECLAIMING—
Danforth, The C. W. Co., Youngstown, Ohio
National Research Co., St. Claire Shores, Mich.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

DIAMOND TOOLS—
Carboloy Dept. of General Electric Co., Detroit Mich.
Indiana Wire Die Co., Ft. Wayne, Ind.
Metal Carbides Corporation, Youngstown, Ohio
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIES—Carbide
(See Dies—Tungsten Carbide)

DIES—Cold Heading
American Carbide Die Company, Union City, N. J.
Carboloy Dept. of General Electric Co., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth-Sterling Steel & Carbide Corp., Pittsburgh, Pa.
Indiana Wire Die Co., Ft. Wayne, Ind.
Metal Carbides Corporation, Youngstown, Ohio.
Vascoloy-Ramet Corp., No. Chicago, Ill.

DIES—Diamond
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., New York, N. Y.
Cochaud Wire Die Corp., New York, N. Y.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
North American Philips Co., Inc., New York, N.Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIES—Extrusion
American Carbide Die Company, Union City, N. J.
Carboloy Dept. of General Electric Co., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth-Sterling Steel & Carbide Corp., Pittsburgh, Pa.
Hartley Tool & Die Co., Thomaston, Conn.
Metal Carbides Corporation, Youngstown, Ohio.
Murex, Ltd., Rainham, England.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIES—Eyelet
American Carbide Die Company, Union City, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Hartley Tool & Die Co., Thomaston, Conn.
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

DIES—Pointing
Sjogren Tool and Machine Co., Auburn, Mass.

DIES—Repairs & Re-Cutting
American Carbide Die Company, Union City, N. J.
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., New York, N. Y.
Carboloy Dept. of General Electric Co., Detroit, Mich.
Cochaud Wire Die Corp., New York, N. Y.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth-Sterling Steel & Carbide Corp., Pittsburgh, Pa.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Hartley Tool & Die Co., Thomaston, Conn.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corporation, Youngstown, Ohio.
New England Wire Die Co., Worcester, Mass.
North American Philips Co., Inc., Allied Products Division, New York, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Wayne Wire Die Co., Hillside, N. J.

DIES—Special Shapes, Etc.
American Carbide Die Company, Union City, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth-Sterling Steel & Carbide Corp., Pittsburgh, Pa.
Hartley Tool & Die Co., Thomaston, Conn.

WHERE TO BUY, Continued

Indiana Wire Die Co., Ft. Wayne, Ind.
Murex, Ltd., Rainham, England.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

DIES—Swaging
Murex, Ltd., Rainham, England
Sjogren Tool and Mach. Co., Inc., Auburn, Mass.

DIES—Tantalum Carbide
American Carbide Die Company, Union City, N. J.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Carboloy Dept. of General Electric Co., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth-Sterling Steel & Carbide Corp., Pittsburgh, Pa.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corporation, Youngstown, Ohio
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.

DIES—Tube Drawing
American Carbide Die Company, Union City, N. J.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Carboloy Dept. of General Electric Co., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth-Sterling Steel & Carbide Corp., Pittsburgh, Pa.
Hartley Tool & Die Co., Thomaston, Conn.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Murex, Ltd., Rainham, England.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.

DIES—Tungsten Carbide
American Carbide Die Company, Union City, N. J.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Carboloy Dept. of General Electric Co., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth-Sterling Steel & Carbide Corp., Pittsburgh, Pa.
Hartley Tool & Die Co., Thomaston, Conn.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Murex, Ltd., Rainham, England.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Wayne Wire Die Co., Hillside, N. J.

DRAW BENCHES—
(See MACHINERY—Draw Benches)

DRUMS & TRAVERSES—Flange Steel
Entwistle, Jas. L. Co., Providence, R. I.
Hubbard Spool Company, Garrett, Indiana
Niles Steel Products Division, Republic Steel Corporation, Niles, Ohio

DRUMS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.
Watson Machine Co., The, Paterson, N. J.

DRYING EQUIPMENT—
Carl-Mayer Corp., The, Cleveland, Ohio
Industrial Ovens, Inc., Cleveland, Ohio
Rockwell, W. S. Co., Fairfield, Conn.
Ross, J. O., Engineering Corp., New York, N. Y.

ENGINEERS—Consulting
Copper—Leonard D. Walde, North Plainfield, N. J.
Metal Fatigue—Fatigue of Materials Laboratory, Princeton, N. J.
Wire Mill—Lewis, Kenneth B., Worcester, Mass.

EQUIPMENT—Insulation Testing
Davis Elec. Co., Wallingford, Conn.
Entwistle, Jas. L. Co., Providence, R. I.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FENCING & FENCES—Wire
Interlocking Fence Co., Morton, Ill.

FLUXES—Soldering
American Chemical Paint Co., Ambler, Pa.

FOAM PRODUCING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Parkin Chemical Company, The, Pittsburgh, Pa.

FRICTION PAY-OFF STANDS—
Industrial Ovens, Inc., Cleveland, Ohio.

FURNACES—Annealing
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Harper Electric Furnace Corp., Niagara Falls, N. Y.
Holden, A. F., Co., The, Detroit, Mich.
Morrison Industries, Bedford, Ohio.
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engr. Co., Cleveland, Ohio.
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Automatic
Electric Furnace Co., Salem, Ohio.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Brazing
Electric Furnace Co., Salem, Ohio.
Rockwell, W. S. Co., Fairfield, Conn.

FURNACES—Bright Annealing
Electric Furnace Co., Salem, Ohio.
Harper Electric Furnace Corp., Niagara Falls, N. Y.
Michigan Oven Co., Detroit, Mich.
Morrison Industries, Bedford, Ohio.
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.

FURNACES—Electric
Electric Furnace Co., Salem, Ohio.
Harper Electric Furnace Corp., Niagara Falls, N. Y.
Rockwell, W. S. Co., Fairfield, Conn.
Trauwood Engineering Co., The, Cleveland, Ohio.
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.

FURNACES—Galvanizing Equipment
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio.
Holden, A. F., Co., The, Detroit, Mich.
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engineering Co., The, Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Hard'ing & Temp'ing
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio.
Harper Electric Furnace Corp., Niagara Falls, N. Y.
Holden, A. F., Co., The, Detroit, Mich.
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engineering Co., The, Cleveland, Ohio.

FURNACES—Lead Melting
Electric Furnace Co., Salem, Ohio.
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Non-Oxidizing
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio.
Holden, A. F., Co., The, Detroit, Mich.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Normalizing
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Harper Electric Furnace Corp., Niagara Falls, N. Y.
Holden, A. F., Co., The, Detroit, Mich.
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Pot (oil, gas, electric)
Ajax Electric Co., Inc., Philadelphia, Pa.
Holden, A. F., Co., The, Detroit, Mich.

FURNACES—Resistance Heating, Strand
Trauwood Engineering Co., The, Cleveland, Ohio.

FURNACES—Salt Bath
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio.
Holden, A. F. Co., The, Detroit, Mich.
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Wire, Strip & Sheet
Carl-Mayer Corp., The, Cleveland, Ohio.
Eisler Engineering Co., Newark, N. J.
Electric Furnace Co., Salem, Ohio.
Harper Electric Furnace Corp., Niagara Falls, N. Y.
Michigan Oven Co., Detroit, Mich.
Morrison Industries, Bedford, Ohio.
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engineering Co., The, Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.

GALVANIZING EQUIPMENT—
Steel Equipment Co., Cleveland, Ohio.
Wean Equipment Corp., Cleveland, Ohio.

GRINDERS—Roll
Norton Co., The, Worcester, Mass.

HAMMERS—Swaging
Sjogren Tool and Machine Co., Auburn, Mass.

HOOKS—Pickling & Liming
Bronze Die Casting Co., Pittsburgh, Pa.
Youngstown Welding & Engineering Co., Youngstown, Ohio.

HOISTS—Electric Travelling
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, Ohio.

IMPREGNATING MATERIALS—
Standard Toch Chemicals, Inc., New York, N. Y.

INHIBITORS—Pickling
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Houghton, E. F. & Co., Philadelphia, Pa.
Parkin Chemical Company, The, Pittsburgh, Pa.
Pennsylvania Salt Mfg. Co., Philadelphia, Pa.

INSULATING LACQUERING SYSTEMS—Continuous
American Insulating Machine Co., Phila., Pa.
Industrial Ovens, Inc., Cleveland, Ohio.

INSULATING MATERIALS—
Glass Fibers, Inc., Waterville, Ohio.
Merrimac Paper Co., New York, N. Y.
New England Lacquer Co., E. Providence, R. I.
Owens Corning Fiberglas Corp., Toledo, O.
Standard-Toch Chemicals, Inc., New York, N. Y.
Twitchell, E. W., Philadelphia, Pa.

INSULATING MATERIALS—Paper—For Electric Wire Cable.
Merrimac Paper Co., New York, N. Y.
Twitchell, E. W., Philadelphia, Pa.

LACQUERS—For Electric Wire
New England Lacquer Co., E. Providence, R. I.
Standard-Toch Chemicals, Inc., New York, N. Y.

LAME—LAHN—
Montgomery Co., The, Windsor Locks, Conn.

LATHES—Die Reaming
Carboloy Dept. of General Electric Co., Detroit, Mich.
Roos, Tool & Mfg. Co., Montclair, N. J.

LIME—
Warner Co., Philadelphia and Bellefonte, Pa.

LININGS—Acid and Alkali Proof
Haveg Corp., Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio

LUBRICANTS — For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Houghton, E. F. & Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Nopco Chemical Co., Harrison, N. J.
Standard Industrial Compounds Co., Chicago, Ill.

LUBRICANTS—Wire Drawing
(See Compounds—Wire Drawing)

LUBRICANTS—Wire Rope
Swift & Co., Chicago, Ill.

LUMBER—Wire Mill, Carload shipments for lagging and car blocking
North Anson Reel Co., No. Anson, Me.

MACHINERY—Armoring (Cable, Wire Hose)
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Barbed Wire
Glader Machine Works, Chicago, Ill.
Wafios, Maschinenfabrik, Reutlingen, Germany
Wean Engineering Co., Cleveland, Ohio.

MACHINERY—Bead Wrapping
Terkelsen Machine Co., Boston, Mass.

MACHINERY—Bolts & Rivets
Meyer, Roth & Pastor Maschinenfabrik, Koln-Radderberg, Germany

MACHINERY—Braiding
Fidelity Machine Co., Inc., Philadelphia, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Wardwell Braiding Machine Co., Central Falls, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

MACHINERY—Brazing
Eisler Engineering Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Bunching
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Federal Manufacturing Co., Wallingford, Conn.
Haskell-Dawes Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

WHERE TO BUY, Continued

MACHINERY—Cable, Electric
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Inc., Philadelphia, Pa.
Haskell-Dawes Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cable, Rope Closing
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Capstans
(See Machinery—Wind-Up)

MACHINERY—Chain Making
Meyer, Roth & Pastor Maschinenfabrik, Koln-Raderberg, Germany

MACHINERY—Coilers
Boyd & Sons Manufacturing Co., Phila., Pa.
Eisler Engineering Co., Newark, N. J.
Entwistle, Jas. L. Co., Providence, R. I.
Morgan Construction Co., Worcester, Mass.
National Machy. Exch. (used) New York, N. Y.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.
Wean Equipment Corp., Cleveland, Ohio
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

MACHINERY—Cold Heading
(See Cold Headers)

MACHINERY—Copper Wire Drawing and Rolling
Aetna-Standard Engineering Co., Youngstown, Ohio
American Insulating Mach'y Co., Phila., Pa.
Fenn Manufacturing Co., The, Hartford, Conn.
National Mach'y Exch. (Used), New York, N. Y.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Covering Wire
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Inc., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Standard Machinery Co., Mystic, Conn.
Syncro Machine Co., Perth Amboy, N. J.
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cutting
Eisler Engineering Co., Newark, N. J.
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool, Inc., New Haven, Conn.
National Mach'y Exch. (Used) New York, N. Y.
Porter, H. K., Inc., Everett, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Die Making
Carboloy Dept. General Electric Co., Detroit, Mich.
Firth-Sterling Steel & Carbide Corp., Pittsburgh, Pa.
Kelly Wire Die Corp., New York, N. Y.
Roos Tool & Mfg. Co., Montclair, N. J.
Wayne Wire Die Co., Hillside, N. J.

MACHINERY—Dielectric Spark Testers
(See Machinery—Spark Testing)

MACHINERY—Draw Benches
Aetna-Standard Engineering Co., Youngstown, Ohio
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Warterweiler, Emilio, Milano, Italy
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Edging
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Electrode Units
(See Machinery—Spark Testing)

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Industrial Ovens, Inc., Cleveland, Ohio
Michigan Oven Co., Detroit, Mich.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Extruding
National Rubber Machinery Co., Akron, Ohio
Royle, John, & Sons, Paterson, N. J.
Standard Machinery Co., Mystic, Conn.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

MACHINERY—Fence
Glader, Wm., Machine Works, Chicago, Ill.
Interlocking Fence Co., Morton, Ill.
Wafios, Maschinenfabrik, Reutlinger, Germany
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Filament Coil Winding
Eisler Engineering Co., Newark, N. J.

MACHINERY—Flat Wire
Fenn Manufacturing Co., The, Hartford, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Stanat Manufacturer Co., Long Island City, N. Y.
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Galvanizing
(See Galvanizing Equipment)

MACHINERY—Galvanizing Wire
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Co., Cleveland, Ohio
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio

MACHINERY—Gang Winders
Entwistle, Jas. L. Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., The, Worcester, Mass.

MACHINERY—Insulating
American Insulating Mach'y Co., Phila., Pa.
Ets. Pourtier Frères, Romainville, France
Fidelity Machine Co., Inc., Philadelphia, Pa.
National Rubber Machinery Co., Akron, Ohio
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Knitting
Fidelity Machine Co., Inc., Philadelphia, Pa.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Looms, Wire Weaving
Interlocking Fence Co., Morton, Ill.
Wartenweiler, Emilio, Milano, Italy

MACHINERY—Magnet Wire
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Material Handling
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

MACHINERY—Measuring Wire & Cable
Davis Electric Co., Wallingford, Conn.
Durant Mfg. Co., Milwaukee, Wis.
Entwistle, Jas. L. Co., Providence, R. I.
New England Butt Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Baird Machine Co., The, Stratford, Conn.
Glader, Wm., Machine Works, Chicago, Ill.
Meyer, Roth & Pastor Maschinenfabrik, Koln-Radberg, Germany
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Wafios, Maschinenfabrik, Reutlinger, Germany
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Panning
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Perth Amboy, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

MACHINERY—Pickling
Chemsteel Construction Co., Pittsburgh, Pa.
Youngstown Welding & Engineering Co., Youngstown, Ohio

MACHINERY—Pin Making
Baird Machine Co., The, Stratford, Conn.
Meyer, Roth & Pastor Maschinenfabrik, Koln-Radberg, Germany

MACHINERY—Pointing
Aetna-Standard Engineering Co., Youngstown, Ohio
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N. Y.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Poultry Wire Fencing
Interlocking Fence Co., Morton, Ill.

MACHINERY—Pre-Heater for Wire (for Extrusion of Plastics)
Industrial Ovens, Inc., Cleveland, Ohio
National Rubber Machinery Co., Akron, Ohio

MACHINERY—Re-Spoolers
American Insulating Mach'y Co., Phila., Pa.
Boyd & Sons Manufacturing Co., Phila., Pa.
Davis Electric Co., Wallingford, Conn.
Eisler Engineering Co., Newark, N. J.
Emory, Robert J., Co., Newark, N. J.
Entwistle, Jas. L. Co., Providence, R. I.
Fidelity Machine Co., Inc., Philadelphia, Pa.
National Mach'y Exch. (Used), New York, N. Y.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Co., Cleveland, Ohio
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.
Wean Equipment Corp., Cleveland, Ohio
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

MACHINERY—Rod Mill
Morgan Construction Co., Worcester, Mass.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Rolling Mill
Morgan Construction Co., Worcester, Mass.
National Machy. Exch. (used) New York, N. Y.
Stanat Manufacturer Co., Long Island City, N. Y.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Engineering Co., Cleveland, Ohio

MACHINERY—Rubber Insulating
National Rubber Machinery Co., Akron, Ohio
Royle, John & Sons, Paterson, N. J.
Standard Machinery Co., Mystic, Conn.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

MACHINERY—Rubber Tubing and Straining
National Rubber Machinery Co., Akron, Ohio
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Mystic, Conn.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

MACHINERY—Screw Wire
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Spark Testing
Davis Electric Co., Wallingford, Conn.
Entwistle, Jas. L. Co., Providence, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

MACHINERY—Special
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Emory, Robert J., Co., Newark, N. J.
Entwistle, Jas. L. Co., Providence, R. I.
New England Butt Co., Providence, R. I.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Siogren Tool and Machine Co., Auburn, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Stanat Manufacturer Co., Long Island City, N. Y.
Standard Machinery Co., Mystic, Conn.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Spring Making
Carlson Company, The, New York, N. Y.
Lundahl Corp., Hartford, Conn.
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Wafios, Maschinenfabrik, Reutlinger, Germany
Wells, Frank L., Co., Kenosha, Wisc.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.
Wafios, Maschinenfabrik, Reutlinger, Germany

MACHINERY—Straightening & Cutting
Fenn Manufacturing Co., The, Hartford, Conn.
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool Co., New Haven, Conn.
Meyer, Roth & Pastor Maschinenfabrik, Koln-Radberg, Germany
National Mach'y Exch. (Used), New York, N. Y.
Nors-Hohm Machine Div. of Nors-Hohm Industries, Inc., Rochester, Michigan
Sleeper & Hartley, Inc., Worcester, Mass.
Wartenweiler, Emilio, Milano, Italy
Wean Equipment Corp., Cleveland, Ohio
Wells, Frank L., Co., Kenosha, Wisc.

MACHINERY—Stranding
Haskell-Dawes Machine Co., Philadelphia, Pa.
Hughesville Machine & Tool Co., Hughesville, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Steel
Aetna-Standard Engineering Co., Youngstown, Ohio
Steel Equipment Co., Cleveland, Ohio
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Swaging
Fenn Manufacturing Co., The, Hartford, Conn.
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Take-Up and Pay-Out Systems
Aetna-Standard Engineering Co., Youngstown, Ohio
Davis Electric Co., Wallingford, Conn.
Federal Manufacturing Co., Wallingford, Conn.
Industrial Ovens, Inc., Cleveland, Ohio

WHERE TO BUY, Continued

Marshall-Richards Machine Co., Inc., Trenton, N.J.
Standard Machine Co., Mystic, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
Ets. Pourtier Frères, Romainville, France
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

MACHINERY—Testing, Physical
Lundahl Corporation, Hartford, Conn.
Scott Testers, Inc., Providenec, R. I.

MACHINERY—Tinning Wire
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
New England Butt Co., Providence, R. I.
Steel Equipment Co., Cleveland, Ohio.
Syncro Machine Co., Perth Amboy, N. J.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill
Marshall-Richards Machine Company, Inc., Trenton, N. J.

MACHINERY—Twinning
(See Mach.—Bunching)

MACHINERY—Twisters, Wire
Cook Manufacturing Co., The, Paterson, N. J.
Davis Electric Co., Wallingford, Conn.
Federal Manufacturing Co., Wallingtord, Conn.

MACHINERY—Welding Wire
Eisler Engineering Co., Newark, N. J.
Micro Products Co., Chicago, Ill.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Winding
American Insulating Mach'y Co., Phila., Pa.
Eisler Engineering Co., Newark, N. J.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Mill Supply, Pawtucket, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Winding Wire
Federal Manufacturing Co., Wallingford, Conn.
Standard Mill Supply, Pawtucket, R. I.

MACHINERY—Wire Bending
Eisler Engineering Co., Newark, N. J.
Kilmer, M. D., & Co., Cleveland, Ohio.

MACHINERY—Wire Drawing
Aetna-Standard Engineering Co., Youngstown, Ohio
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Fenn Manufacturing Co., The, Hartford, Conn.
Kurt Orban Co., Inc., New York, N. Y.
Marshall-Richards Machine Co., Inc., Trenton, N.J.
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N. Y.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Co., Cleveland, Ohio.
Svenska Telegrambyran (Morgardshammer), Stockholm, Sweden
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Wire Forming
Baird Machine Co., The, Stratford, Conn.
Kilmer, M. D. & Co., Cleveland, Ohio.
Meyer, Roth & Pastor Maschinenfabrik, Koln-Radderberg, Germany
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Wafios, Maschinenfabrik, Reutlinger, Germany

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wood Screw
National Mach'y Exch. (Used), New York, N. Y.

MACHINERY—Wrapping Straight Lengths and Tubing
Angier Corporation, The, Framingham, Mass.
Terkelsen Machine Co., Boston, Mass.

MACHINERY—Wrapping Wire Coils
Angier Corporation, The, Framingham, Mass.
Terkelsen Machine Co., Boston, Mass.

MATERIAL HANDLING EQUIPMENT—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

MILLS—Tandem, Rolling & Edging
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Co., Cleveland, Ohio.

NAILS—Wire
American Steel & Wire Co., Cleveland, Chicago, New York.
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling, John A. Sons Co., Trenton, N. J.
Wickwire Brothers, Inc, Cortland, N. Y.

OVENS—Cable Lacquering
American Insulating Mach'y Co., Phila., Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio.
Michigan Oven Co., Detroit, Mich.
Morrison Industries, Bedford, Ohio
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.

OVENS—Dehydrogenizing
Industrial Ovens, Inc., Cleveland, Ohio.

OVENS—Industrial
Industrial Ovens, Inc., Cleveland, Ohio.
Michigan Oven Co., Detroit, Mich.
Ross, J. O., Engr. Corp., New York, N. Y.

OVENS—Rod Bakers
Carl-Mayer Corp., The, Cleveland, Ohio.
Michigan Oven Co., Detroit, Mich.
Morrison Industries, Bedford, Ohio
Ross, J. O., Engr. Corp., New York, N. Y.

OVENS—Welding Rod Coating
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio.
Morrison Industries, Bedford, Ohio
Ross, J. O., Engr. Corp., New York, N. Y.

PAINT—Acid Proof
Ceilcote Company, Cleveland, Ohio.
Standard-Toch Chemicals, Inc., New York, N. Y.

PAINT BONDING CHEMICALS—
American Chemical Paint Co., Ambler, Pa.

PAINTS—Heat Resisting
American Chemical Paint Co., Ambler, Pa.
Standard-Toch Chemicals, Inc., New York, N. Y.

PANS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

PAPER—Creped Wrapping
Angier Corporation, The, Framingham, Mass.
Arkell Safety Bag Co., New York, N. Y.
Crepe-Kraft Company, The, Division National Waterproof Papers, Inc., Newark, N. J.
Terkelsen Machine Co., Boston, Mass.

PAPER—For Coil Wrapping and Corrosion Prevention
Angier Corporation, The, Framingham, Mass.
Arkell Safety Bag Co., New York, N. Y.
Crepe-Kraft Company, The, Division National Waterproof Papers, Inc., Newark, N. J.
Terkelsen Machine Co., Boston, Mass.

PATENT ATTORNEYS—
Lancaster, Allwine & Rommel, Washington, D. C.

PAY-OUT SYSTEMS—
(See Wind-up and Unwind Systems)

PHOSPHATE COATING CHEMICALS—
American Chemical Paint Co., Ambler, Pa.

PICKLING COMPOUNDS—
See (Inhibitors—Pickling)

PICKLING—Hooks, etc. Acid Resisting
Bronze Die Casting Co., Pittsburgh, Pa.
Youngstown Welding & Eng. Co., Youngstown, O.

PICKLING TANK LININGS—
Chemsteel Construction Co., Pittsburgh, Pa.
Haveg Corp., Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio.

PIPES & FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio.

PLASTIC TESTERS—
Scott Testers, Inc., Providence, R. I.

PNEUMATIC CYLINDERS—
Entwistle, Jas. L. Co., Providence, R. I.

POTS—Lacquer
Industrial Ovens, Inc., Cleveland, Ohio.

PRESSES—Hydraulic and Mechanical
Standard Machinery Co., Mystic, Conn.

PULLERS AND GRIPS—For Wire
Morgan Construction Co., Worcester, Mass.
Scudder, E. J. Fdry & Mach. Co., Trenton, N. J.
Siogren Tool and Machine Co., Auburn, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio.

REEL AND TENSION STANDS—
Davis Electric Co., Wallingford, Conn.
Entwistle, Jas. L. Co., Providence, R. I.
Industrial Ovens, Inc., Cleveland, Ohio.
Roll-a-Reel, Cincinnati, Ohio.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Mill Supply Co., Pawtucket, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

REEL CRUTCHES—
Roll-a-Reel, Cincinnati, Ohio
Watson Machine Co., Paterson, N. J.

REELS & SPOOLS—Drawn Aluminum Alloy
Acrometal Products, Inc., Minneapolis, Minn.
Hubbard Spool Co., Garrett, Indiana

REELS & SPOOLS—Annealing and Stranding
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Co., Garrett, Indiana
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp. Niles, Ohio.

REELS & SPOOLS—Collapsible
Entwistle, Jas. L. Co., Providence, R. I.

REELS & SPOOLS—Plastic
Hubbard Spool Co., Garrett, Indiana

REELS & SPOOLS—Steel
Apco Mossberg Co., Attleboro, Mass.
Britelite Distributors, Inc., Brooklyn, N. Y.
Clark, J. L., Mfg. Co., Rockford, Ill.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Co., Ganett, Indiana
Mason Can Company, East Providence, R. I.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp. Niles, Ohio.

REELS AND SPOOLS—Shipping and Shop
Acrometal Products, Inc., Minneapolis, Minn.
American Woodworking Co., Chicago, Ill.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg. Co., Inc., The, Hazardville, Conn.
Clark, J. L., Mfg. Co., Rockford, Ill.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Co., Garrett, Indiana
Mason Can Company, East Providence, R. I.
McCaskie, Inc., Wm., Westport, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp. Niles, Ohio.
North Anson Reel Co., No. Anson, Me.
Proctor Reels, Proctorville, Vt.

REELS & SPOOLS—Wooden
Acrometal Products, Inc., Minneapolis, Minn.
American Woodworking Co., Chicago, Ill.
Bridge Mfg. Co., Inc., The, Hazardville, Conn.
Durkee Mfg. Co., Pine River, Minn.
North Anson Reel Co., No. Anson, Me.
No. Waterford Spool Co., No. Waterford, Me.
Proctor Reels, Proctorville, Vt.

REELS—Metal Bound
Durkee Mfg. Co., Pine River, Minn.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Co., Garrett, Indiana
McCaskie, Inc., Wm., Westport, Mass.
North Anson Reel Co., No. Anson, Me.

REELS—Pay-off
Nors-Holm Industries, Rochester, Mich.

REELS—Takeoff
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg. Co., The, Hazardville, Conn.
Clark, J. L., Mfg. Co., Rockford, Ill.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Co., Garrett, Indiana
McCaskie, Inc., Wm., Westport, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp. Niles, Ohio.
North Anson Reel Co., No. Anson, Me.
Proctor Reels, Proctorville, Vt.

REELS—Vulcanizing & Impregnating
Apco Mossberg Co., Attleboro, Mass.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Co., Garrett, Indiana
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio

REELS—Wire Drawing
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Co., Ganett, Indiana
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

WHERE TO BUY, Continued

REELS—Wire Mill
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg. Co., The, Hazardville, Conn.
Britelite Distributors, Inc., Brooklyn, N. Y.
Durkee Mfg. Co., Pine River, Minn.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Garrett, Indiana
Mason Can Company, East Providence, R. I.
McCaskie, Inc., Wm., Westport, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp. Niles, Ohio.
North Anson Reel Co., No. Anson, Me.
Proctor Reels, Proctorville, Vt.

REFRACTORIES—High Temperature
Norton Company, Worcester, Mass.

RESISTANCE HEATING—Annealing Patenting, Etc.
Trauwood Engr. Co., Cleveland, Ohio.

ROD BAKERS—
(See Ovens—Rod Bakers)

RODS—Stainless Steel
American Steel & Wire Co., Cleveland, Ohio.
U. S. Steel Co., N. Y., N. Y.

RODS—Wire—Non-Ferrous
American Brass Co., The, Waterbury, Conn.
Platt Bros. & Co., The, Waterbury, Conn.

RODS—Wire, Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Erie Iron & Supply Corp., Erie, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Company, Pittsburgh, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.
Montan Export, Inc., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

ROPE—Wire
American Steel & Wire Company, Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Roebling's John A., Sons Co., Trenton, N. J.

RUBBER AND RUBBER COMPRESSION TESTERS—
Scott Testers, Inc., Providence, R. I.

RUST PROOF COMPOUNDS—
(See Compounds—Rust Preventing)

RUST REMOVING COMPOUNDS—
(See Compounds—Rust Preventing)

SALTS—Heat Treating, Descaling, etc.
Holden, A. F., Co., The, Detroit, Mich.
Houghton, E. F. & Co., Philadelphia, Pa.

SATURATION SYSTEMS—
Industrial Ovens, Inc., Cleveland, Ohio.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

SOAPS—Industrial and Wire Drawing
(See Compounds—Wire Drawing)

SODIUM—for Descaling
Holden, A. F., Co., The, Detroit, Mich.

SOLVENT RESIN SYSTEMS—Experimental
Industrial Ovens, Inc., Cleveland, Ohio.

SPOOLS—(See Reels & Spools)

SPOOLS—Stamped Metal for Retail Wire Sales
Clark, J. L. Mfg. Co., Rockford, Ill.
Mason Can Co., East Providence, R. I.

STAMPINGS—Steel
Hubbard Spool Company, Ganett, Indiana
Mossberg Pressed Steel Corp., Attleboro, Mass.

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Roebling's John A., Sons Co., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

SWIFTS—Take-off
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Watson Machine Co., Paterson, N. J.

TANKS—Compound
Haveg Corp., Newark, Del.
Watson Machine Co., Paterson, N. J.

TANKS—Pickling
Ceilcote Company, Cleveland, Ohio.
Chemsteel Construction Co., Pittsburgh, Pa.
Haveg Corp., Newark, Del.

TANKS—Steel
Chemsteel Construction Co., Pittsburgh, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.

TINNING PROCESS—
Metal & Thermit Corp., New York, N. Y.

TINSEL—Cords, Decorative
(See: Tinsel—Electric Conductor)

TINSEL—Electric Conductor
Montgomery Co., The, Windsor Locks, Conn.

TINSEL—Electric Resistance
(See: Tinsel—Electric Conductor)

TINSEL—Lame, Silver and False Gold
(See: Tinsel—Electric Conductor)

TINSEL—Thread, Silver and False Gold
(See: Tinsel—Electric Conductor)

TINSEL—Thread, Decorative
(See: Tinsel—Electric Conductor)

TINSEL—Wire
(See: Tinsel—Electric Conductor)

TOOLS—Spring Forming
Lundahl Corporation, Hartford, Conn.

TOOLS—Wire Cutting
Porter, H. K., Inc., Everett, Mass.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

TRAVERSES & DRUMS—For Reels
(See Drums & Traverses)

TRAVERSE MECHANISMS—
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Niles Steel Products Div., Republic Steel Corp. Niles, Ohio
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

TUBE BENDERS AND FORMERS—
H. D. Kilmer Co., Cleveland, Ohio.

TURKS HEADS—
Fenn Manufacturing Co., The, Hartford, Conn.

VALVES & FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.

VARNISHES—for Electric Wire
N. E. Lacquer Co., E. Providence, R. I.
Standard-Toch Chemicals, Inc., New York, N. Y.

VULCANIZERS—
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS—
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.

WELDERS—Spot and Butt
Eisler Engineering Co., Newark, N. J.
Micro Products Co., Chicago, Ill.

WIND-UP AND UNWIND SYSTEMS—Continuous
American Insulating Mach'y Co., Phila., Pa.
Davis Electric Co., Wallingford, Conn.
Entwistle, Jas. L. Co., Providence, R. I.
Federal Manufacturing Co., Wallingford, Conn.
Industrial Ovens, Inc., Cleveland, Ohio
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

WIRE—Alloy
Montan Export, Inc., New York, N. Y.

WIRE—Aluminum
Elmet Division, North American Philips Company, Inc., Lewistown, Maine
Malin & Co., Cleveland, Ohio
Seneca Wire & Manufacturing Co., Fostoria, Ohio

WIRE—Barbed
Interlocking Fence Co., Morton, Ill.

WIRE—Cast
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Cold Heading
American Steel & Wire Co., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Erie Iron & Supply Corp., Erie, Pa.
Gerber, J., & Co., Inc., New York, N. Y.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's John A., Sons Co., Trenton, N. J.
Seneca Wire & Manufacturing Co., Fostoria, Ohio
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Coppered
Gerber, J., & Co., Inc., New York, N. Y.

WIRE—Electric
American Brass Co., The, Waterbury, Conn.
Britelite Distributors, Inc., Brooklyn, N. Y.
Chase Brass & Copper Co., Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.
Malin & Co., Cleveland, Ohio

WIRE—Flat, Fine
Elmet Division, North American Philips Company, Inc., Lewistown, Maine
Montgomery Co., The, Windsor Locks, Conn.

WIRE—Galvanized
Gerber, J., & Co., Inc., New York, N. Y.

WIRE—Manufacturers
American Steel & Wire Co., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Continental Steel Corp., Kokomo, Ind.
Gerber, J., & Co., Inc., New York, N. Y.
Johnson Steel & Wire Co., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
Montan Export, Inc., New York, N. Y.
Newbury Company, The, Boston, Mass.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.
Seneca Wire & Manufacturing Co., Fostoria, Ohio
U. S. Steel Co., N. Y., N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Music
American Brass Co., The, Waterbury, Conn.
American Steel & Wire Co., Cleveland, Ohio
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Malin & Co., Cleveland, Ohio
Montan Export, Inc., New York, N. Y.
Newbury Company, The, Boston, Mass.
Seneca Wire & Manufacturing Co., Fostoria, Ohio
Specialty Wire Co., Inc., Worcester, Mass.

WIRE—Nickel Silver and Phosphor Bronze
American Brass Co., The, Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.
Malin & Co., Cleveland, Ohio.
Chase Brass & Copper Co., Waterbury, Conn.

WIRE—Non-Ferrous to Specifications for Special Purposes
American Brass Co., The, Waterbury, Conn.
American Steel & Wire Co., Cleveland, Ohio
Chase Brass & Copper Co., Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.
North American Philips Co., Inc., Allied Products Division, New York, N. Y.

WIRE—Oil Tempered
Pittsburgh Steel Co., Pittsburgh, Pa.

WIRE—Spring
American Brass Co., The, Waterbury, Conn.
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
Newbury Company, The, Boston, Mass.
Pittsburgh Steel Co., Pittsburgh, Pa.
Seneca Wire & Manufacturing Co., Fostoria, Ohio
Specialty Wire Co., Inc., Worcester, Mass.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Stainless Steel
American Steel & Wire Co., Cleveland, Ohio
Firth Sterling Steel & Carbide Co., Pittsburgh, Pa.
Specialty Wire Co., Inc., Worcester, Mass.

WIRE—Steel—Also Coppered and Galvanized Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Erie Iron & Supply Corp., Erie, Pa.
Gerber, J., & Co., Inc., New York, N. Y.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Seneca Wire & Manufacturing Co., Fostoria, Ohio
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Straightening and Cutting
Erie Iron & Supply Corp., Erie, Pa.
Pittsburgh Cut Wire Co., Pittsburgh, Pa.
Wickwire Brothers, Inc., Cortland, N. Y.

WIRE—Tungsten
North American Philips Co., Inc., Allied Products Division, New York, N. Y.

WIRE—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

WIRE CLOTH—Industrial
Roebling's, John A., Sons Co., Trenton, N. J.
Wickwire Brothers, Inc., Cortland, N. Y.

WIRE—Weaving (Non-Ferrous)
American Brass Co., The, Waterbury, Conn.
Chase Brass & Copper Co., Waterbury, Conn.

WRAPPING PAPER—Creped
Angier Corporation, The, Framingham, Mass.
Arkell Safety Bag Co., New York, N. Y.
Crepe-Kraft Company, The, Division National Waterproof Papers, Inc., Newark, N. J.

YARNS & TAPES—
Glass Fibers, Inc., Waterville, Ohio
Owens Corning Fiberglas Corp., Toledo, Ohio
Twitchell, E. W., Philadelphia, Pa.

YARN TESTERS—
Scott Testers, Inc., Providence, R. I.

The WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON 3, NEW JERSEY, U. S. A.

ELECTRICAL WIRE AND CABLE, WIRE ROPE, CORDAGE AND MASTICATING MACHINERY MANUFACTURERS

WATSON

EXTRUDER TAKEUPS TYPE "V"

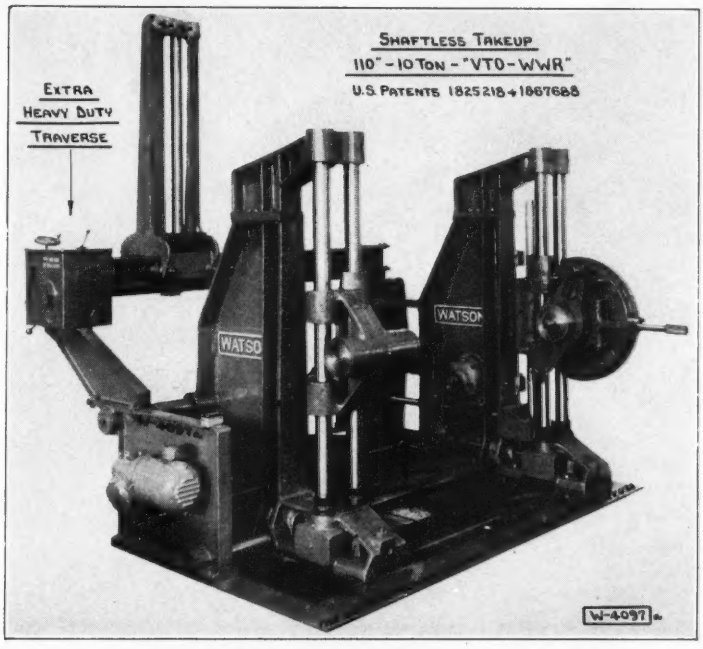
These heaviest-duty units are available in four sizes, all of which possess these notable advantages:

SAFETY: **No reelshaft handling accidents possible.**

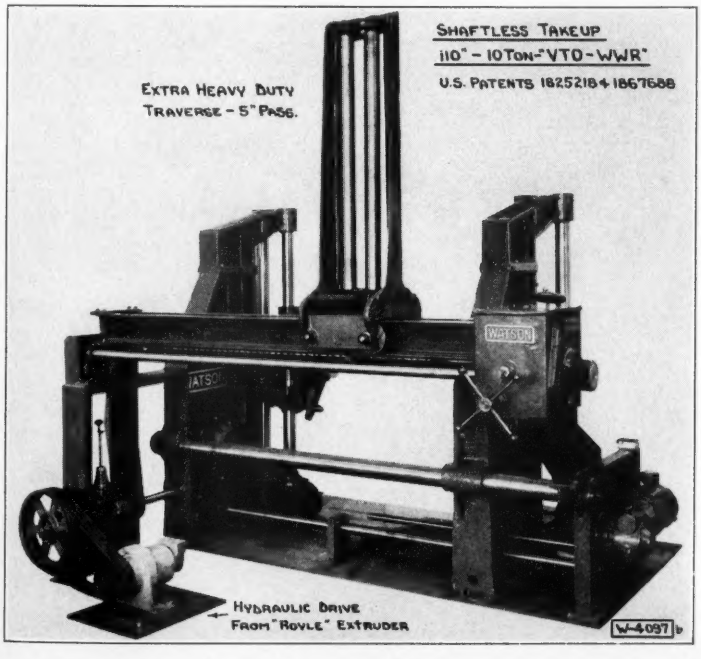
EASE: **No effort required to manipulate all controls.**

RAPIDITY: **Less than one minute required for reel change.**

Unit shown here winds extruded cables to 5" dia. at speeds to 250 feet per minute.



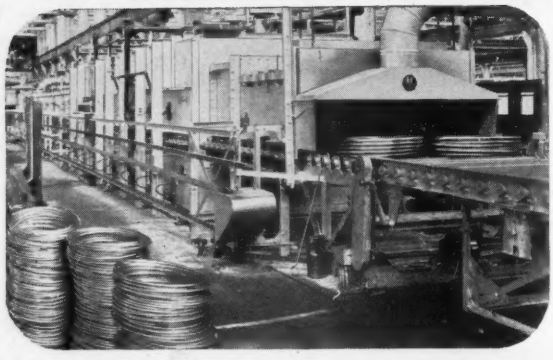
Readily convertible to all general purpose winding applications.


SHAFTLESS TAKEUP
110" - 10 TON - "VTO-WWR"
U.S. PATENTS 1825218+1867688
EXTRA HEAVY DUTY TRAVERSE - 5" PASS.
HYDRAULIC DRIVE FROM "ROYLE" EXTRUDER
W-4097b

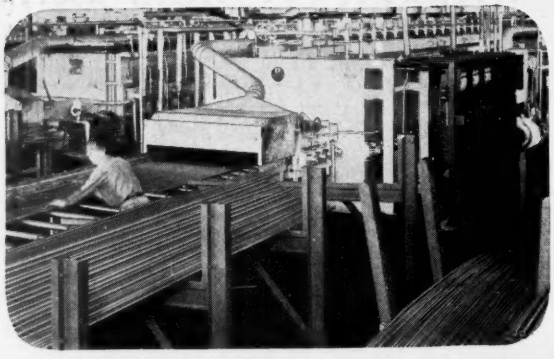
Other type "V" designs are self-powered, provided with various reel speed controls and a variety of traverses—All designed to meet requirements.

All our takeups obtainable from extruder manufacturers with their complete machines.

DESCRIPTIVE LITERATURE ON REQUEST.



Straight lengths of brass and copper tubing are also bright and scale-free annealed in this EF gas fired furnace. Capacity 4000 lbs. per hour.

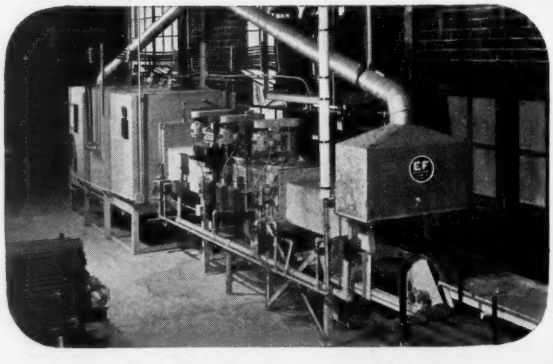


EF gas fired forced convection continuous roller hearth special atmosphere furnace bright annealing long straight lengths of tubing.

ANNEALING TUBING BRIGHT and CLEAN *Continuously*

We have built many outstanding production furnaces for processing copper, brass, stainless, aluminum, nickel silver and other ferrous and non-ferrous tubing—in large and small coils—straight lengths, long and short, and in various diameters—also for many other products and processes.

Put your production furnace problems up to experienced engineers — *it pays.*



A special atmosphere belt conveyor electric furnace annealing short lengths of alloy tubing—operates at temperatures up to 2040° F.

3000 lbs. of steel tubing, per hour, are bright normalized in this EF gas fired radiant tube type special atmosphere furnace.

Straight lengths of tubing up to 5" in diameter and ¾" thick are also annealed in this EF forced circulation roller hearth furnace.

EF

Gas-Fired, Oil-Fired and Electric Furnaces

for any Process, Product or Production

THE ELECTRIC FURNACE CO.

WILSON ST. at PENNA. R. R. *Salem - Ohio*